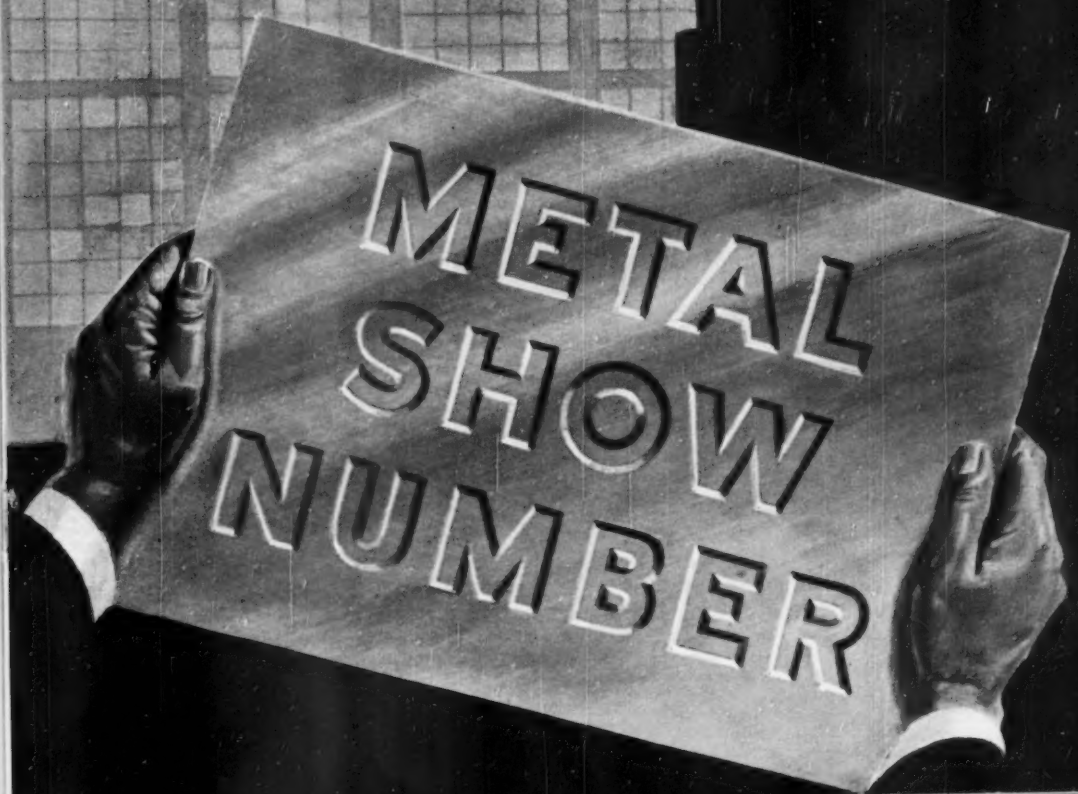
American Machinist

McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

OCTOBER 16, 1950



what is today's best investment?

When it comes to paying real dividends, you can't beat new Heald equipment!

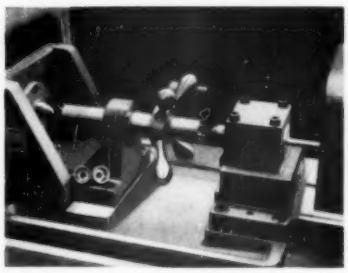
There's no guesswork about an investment in a new Heald machine. The dividends it will pay are a matter of simple arithmetic.

Compare the production rates of the new machine with those of the one it will replace. Then compare the production costs, as related to the net investment required. You'll find that the new, faster, more effficient Heald machine will give you an assured return of 20% — 30% — 50% — and in some cases as much as 100% or more — depending on the *efficiency* (not the age) of the old machine.

Where else today can your invested capital return dividends like these?

Your nearest Heald representative will be glad to study your precision finishing operations and show you exactly how much you can save with a new Heald Bore-Matic, Internal Grinder or Surface Grinder.

Remember, when it comes to precision finishing, it pays to come to Heald.



This New Heald Bore-Matic paid for itself in 11 months!

Used in the tool room of a large diesel manufacturer, this Heald Bore-Matic released three men to other production, saved 20 hours a week of tool room time, and paid off its own cost in 11 months. It is used to finish-bore, face-counterbore, and finish-ream injector system parts to tolerances of 0.0001 and 0.0002 in.

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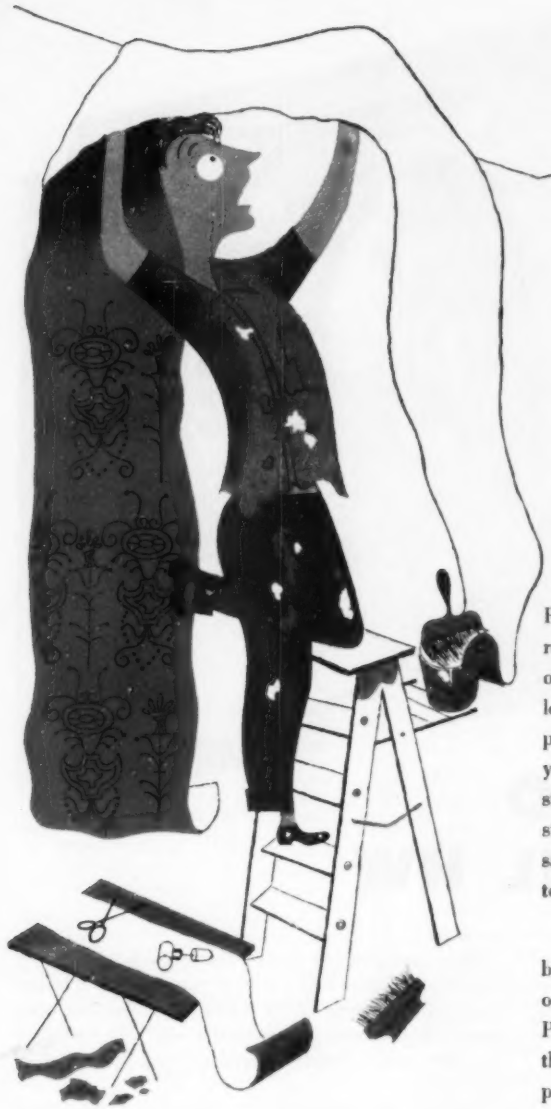

some things need experience

Putting stainless steel to work in a given application requires experience. Since stainless is a whole family of steels, the *right* analysis must be used . . . or stainless steel will not function properly. That's why Crucible, pioneer in the development of this specialty, offers you, freely, the experience of an alert metallurgical staff. These engineers and metallurgists know which stainless fits your job best . . . and their advice can save you time and money in applying stainless steel to your requirements.

The painstaking care Crucible shows in finding the best answer to Industry-posed problems is the measure of Crucible's half century of specialty steel leadership. Put this experience to work for you. And, whether the order is in tons or pounds, your problem is assured prompt attention. When it's stainless . . . call in Crucible. CRUCIBLE STEEL COMPANY OF AMERICA, Chrysler Building, New York 17, N.Y.

CRUCIBLE first name in special purpose steels

STAINLESS STEELS

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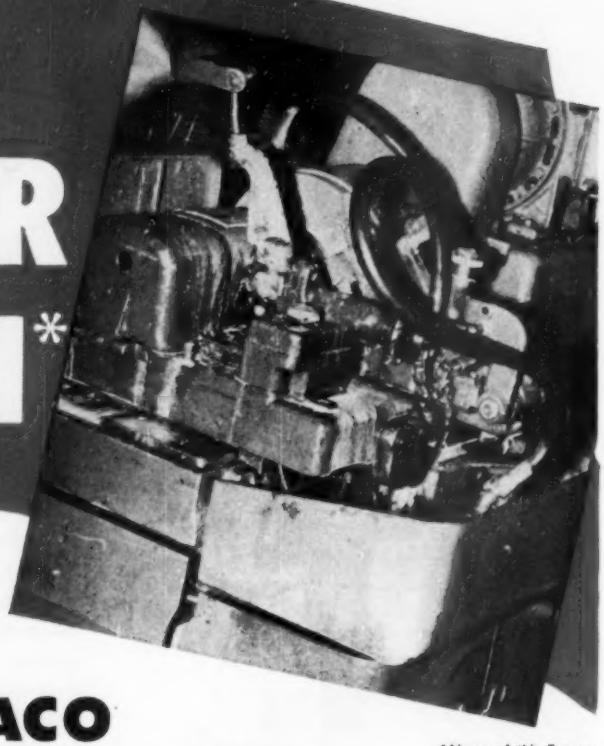
GETS BETTER FINISH*



When grinding with TEXACO SOLUBLE OIL HW

* Name of this Texaco user on request

The machine operator's reasons for preferring *Texaco Soluble Oil HW* are important. First of all, he says, it doesn't irritate, doesn't make his eyes smart, doesn't have a bad odor. Also, *Texaco Soluble Oil HW* assures a finish that is always uniformly fine, rust-free and smooth.

Texaco Soluble Oil HW is made especially for use in hard water areas. It makes a perfect grinding emulsion—one with high stability that keeps the work cool and prevents distortion from frictional heat. Emulsions made with *Texaco Soluble Oil HW* settle out the grinding dirt quickly, keep wheels from loading, assure greater production at lower cost.

There is a complete line of *Texaco Cutting, Grinding and Soluble Oils* to help you do *all* your machining better, faster, more economically. A Texaco Lubrication Engineer, specializing in cutting fluids, will gladly help you select the right ones to improve metal working operations in your plant.

Just call the nearest of the more than 2,000 Texaco Wholesale Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

VISIT THE TEXACO EXHIBIT AT THE METALS SHOW • BOOTH 1906 • CHICAGO, OCTOBER 23-27

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American Machinist

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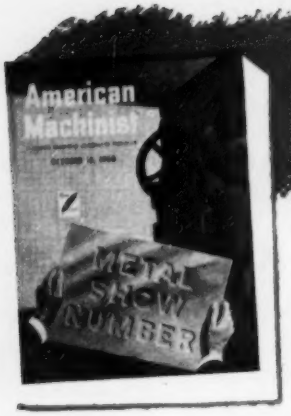


Chips and QUIPS

Imagineering . . . The Metal Show, to be held in International Amphitheater, Chicago, Oct. 23-27, provides the theme for our cover, painted in tempera by Theodore Van Gorp. Recognizing Metal Show emphasis on materials and presswork, the cover shows a theoretical brass press job, with a heavy automotive body press in the background. On the window is the Red Feather, emblem of current Community Chest campaign.

Colvin Day . . . Fred Colvin, our editor emeritus, drove up to Springfield, Vt., in August for a visit. The next day, E. W. Miller, president of Fellows Gear Shaper Co., proclaimed "Colvin Day" at his summer place, and invited a number of "old-timers." Mason Britton (formerly *AM* general manager) came from Boothbay Harbor, Me.; Clayton Burt came up from Pawtucket, R. I.; H. H. Pease drove over from New Britain, Conn.; David Ayr from Torrington, Conn.; James Y. Scott from Springfield, Mass.; Bob Haynes (Spicer Mfg. Co.), Jack Lovely (Jones & Lamson) and Mr. Miller completed the party. Said Fred, "It was *some* party—a real compensation for getting to be so damned old!"

Metal Show . . . In addition to our cover, this issue inclines toward the forthcoming Metal Show by incorporating a floor plan and list of exhibitors and by providing descriptions and photos of new Metalworking equipment to be shown there and which we have not previously described. Also, entire article content of the issue is devoted to heat-treating, welding, presswork and forging—themes of the exhibits there and of the meetings of societies.

Tool & Die Steels . . . Classification, properties, selection, forging, machining and heat-treatment of familiar tool and die steels are covered in our current Special Report. To produce it, Associate Editor Ashburn contacted 50 to 60 companies, classified material by the new AISI tentative standard. Part II, giving trade names, will appear Nov. 27.

Replacement . . . Latest in our continuing series on replacement is the description of Barber-Colman's adaptation of the MAPI system, with practical examples of its application. The company uses the method both in its plant and in its selling. Editor Burnham Finney writes the story.

Carburizing . . . We've been waiting some time for T. A. Frischman, chief metallurgist of Eaton Mfg. Co., to complete a manuscript on carburizing. We have it now, and are presenting it in a series of articles starting in this issue. You'll find it includes latest and best practice, compiled by an expert.

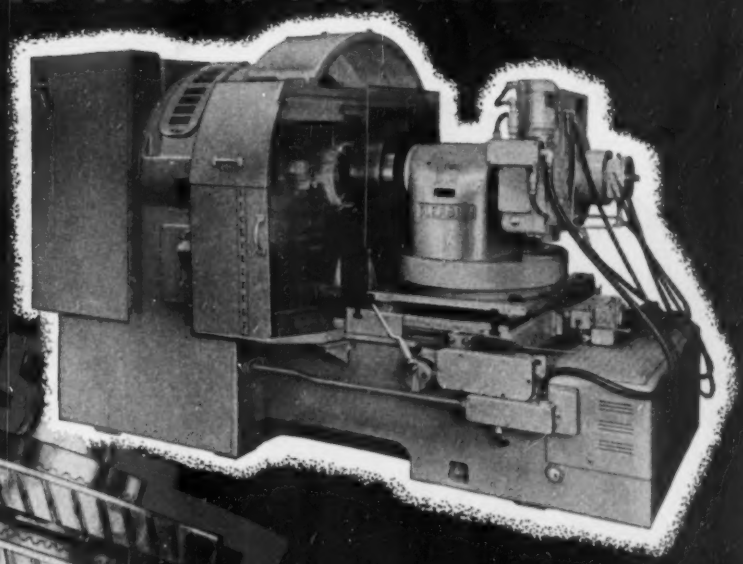
Business . . . Robert Regner of Mohnton, Pa., wrote us a couple of months ago that he had a bound 1884 volume of *AM*. We quoted him in "Backlash" for Aug. 21. Result: Three inquiries, a sale.

Isolation . . . C. H. Smith, Jr., of Steel & Improvement & Forge Co., has described for us the spring mounts his company has placed under six big forging hammers, and how they affect production. Results were very good—and surprising in some respects . . . We also bring you in this issue the details of locating end-welding studs by templet.

Coming . . . Oct. 30 *AM* will be quite special in some respects. The Special Report will be a ready-reference index of articles on armament production published in *AM* in the last ten years—just in case you have a contract, or anticipate one. There'll be a Paquin article on trimming dies, a description of a pneumatic setup for conveying chips and another of an air feed. There'll be a story on boring big rods, another installment on carburizing, and other features as well. The cover will picture hf automatic welding.

LATHEMAN . . . A native of Cleveland, E. L. Murray received his BSME from Purdue, where he majored in Business Administration and Industrial Engineering. Joining the Warner & Swasey Company about 15 years ago, he entered the Special Apprenticeship School and worked through various shop departments for two years. He spent the next several years in the Research Laboratory, in the Tool Design and Tool Testing Departments, as well as the Turret-Lathe Job-Estimating Dept. He became in 1943 field engineer in the Southwest, later in Upper New York. About 1948, he was returned to the home office as supervisor in charge of Turret-Lathe Estimating. He is now Boston engineer. He is on the ASME Special Research Committee on Metal Cutting and is a contributor to the ASME *Handbook on Metal Cutting*, the *ASTE Manufacturing Analysis*, and the latest edition of Kent's *Mechanical Engineers Handbook*. He wrote for us the turret-lathe article in our Oct. 2 issue.

INTERCHANGEABLE COUPLINGS GROUND FROM THE SOLID



• The Gleason No. 19 Curvic Coupling Grinder produces ground Curvic and Zerol face couplings automatically with a uniformity of machining which makes each part interchangeable. Replacement costs of large units can be materially reduced by using built-up units employing the principle of the permanent couplings.

The Gleason No. 19 Curvic Coupling Grinder with its automatic cycle control insures precision operation while the automatic dressing operation provides larger grinding wheel and diamond life.

GLEASON *Works*

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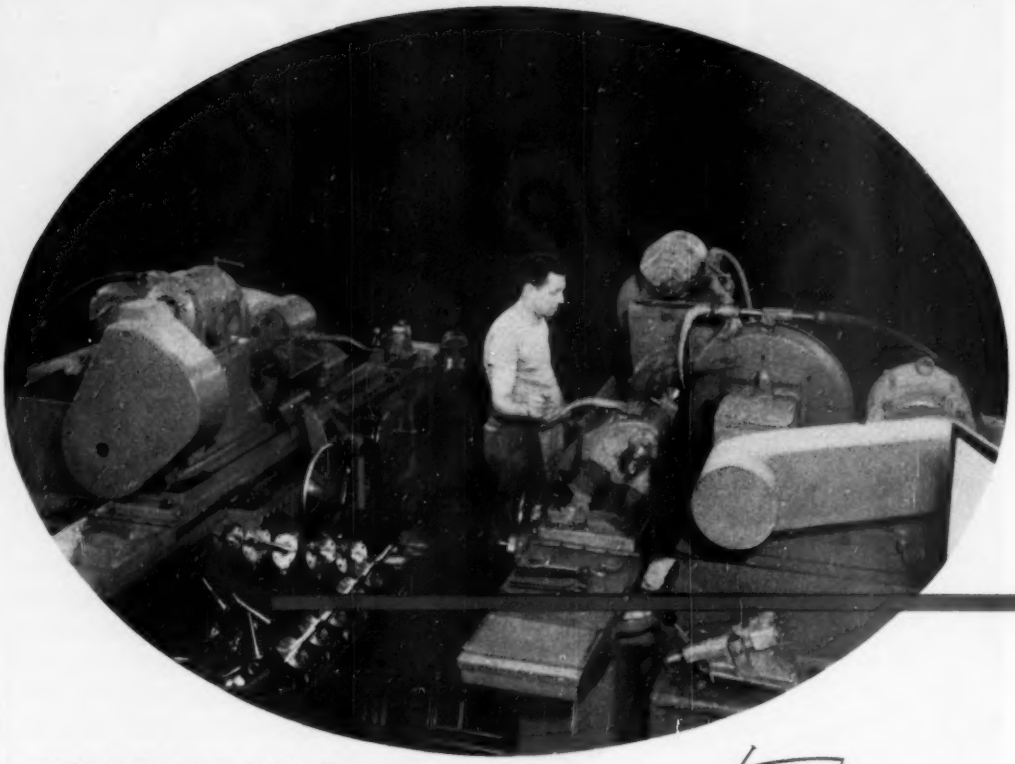
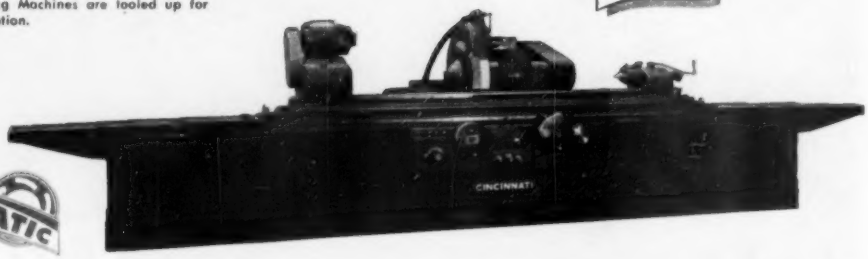
Combining Centertype



Grinding two diameters of steering knuckles, in one infeed cycle, removing an unusually large amount of stock and producing a high-quality finish within 20 micro-inches. Two CINCINNATI FILMATIC 14"-L x 36" Plain Hydraulic Grinding Machines are tooled up for one-man operation.

REPLACE WITH A *NEW* CINCINNATI



FILMATIC

CINCINNATI FILMATIC Grinders offer you the highest return for your precision grinding machine investment. You may obtain complete information on the small sizes of plain machines by writing for the literature tabulated below:

4" Plain Hydraulic, catalog No. G-551-1
8" and 10"-L Plain Hydraulic, catalog No. G-566
10" and 14"-L Plain Hydraulic, catalog No. G-572

CINCIN

Grinding Operations

...INCREASES PRODUCTION 50%

A simple maxim for reducing costs of centertype grinding: "combine operations." Whenever operations can be combined, costs will be lowered, sometimes cut in half. In the illustration on the opposite page, two CINCINNATI FILMATIC 14"-L x 36" Plain Hydraulic Grinding Machines, in the plant of a prominent automotive parts manufacturer, are tooled up to grind simultaneously two diameters of steering knuckles.

One man, operating two machines, increased production 50% over the output of two operators on the two machines which were replaced.

Centertype grinding on CINCINNATI FILMATICS offers many advantages for work of this type. FILMATIC spindle bearings of themselves—a CINCINNATI exclusive—are reason enough to choose CINCINNATI, for they are self-adjusting, good for the life of the machine. Other cost reducing features of these two 14"-L Plains, tooled up by Cincinnati Application Engineers, include:

Automatic Infeed . . . Dual FILMATIC bearings for grinding wheel and headstock spindles . . . Selected Position Stopping for headstock spindle . . . Table Type Profile Wheel Truing with interchangeable cams . . . Automatic Wheel Balancing . . . Multiple Wheel Mount, and a host of other cost reducing features.

In no other precision grinding machine can you get the combination of advantages outlined here. Would you like to know how they can reduce costs in your shop? Write to Department ES, enclosing blueprint of parts and complete specifications.

CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO

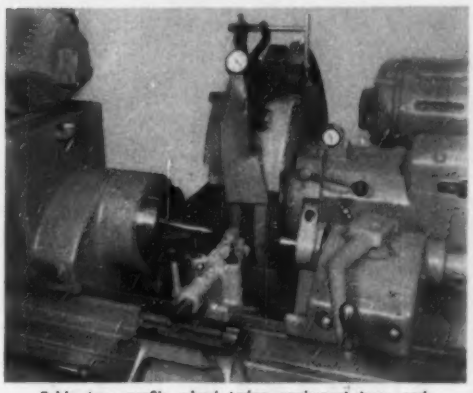
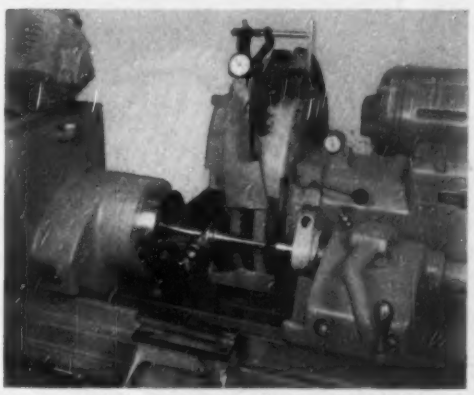


Table type profile wheel truing equipment trues and dresses the wheels in accurate relation to each other.



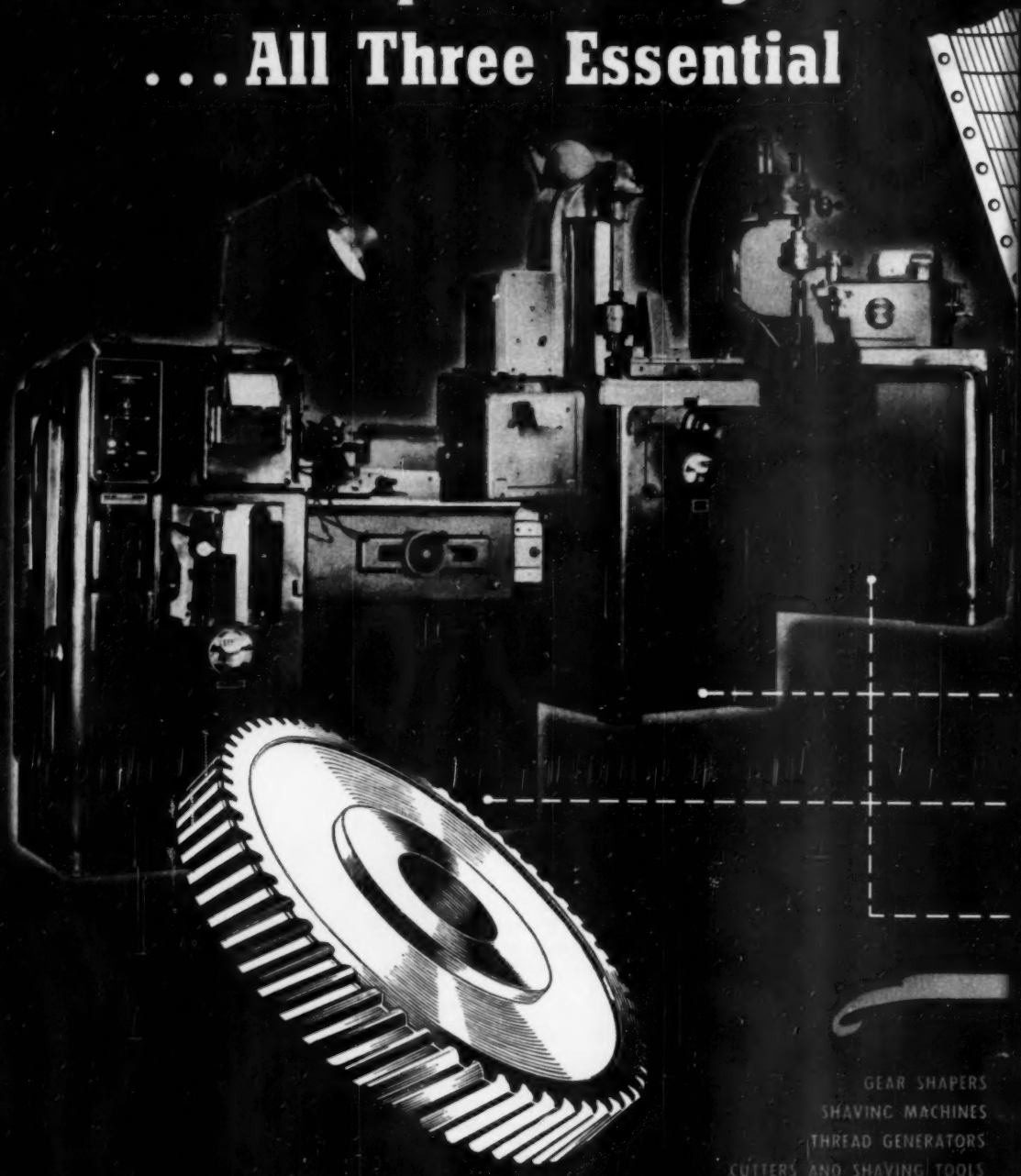
A two wheel mount provides the means of grinding two diameters in each infeed cycle.

CINCINNATI

NATI

CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES
CENTERLESS LAPPING MACHINES • MICRO-CENTRIC GRINDING MACHINES

Essentially Watchdogs ... All Three Essential



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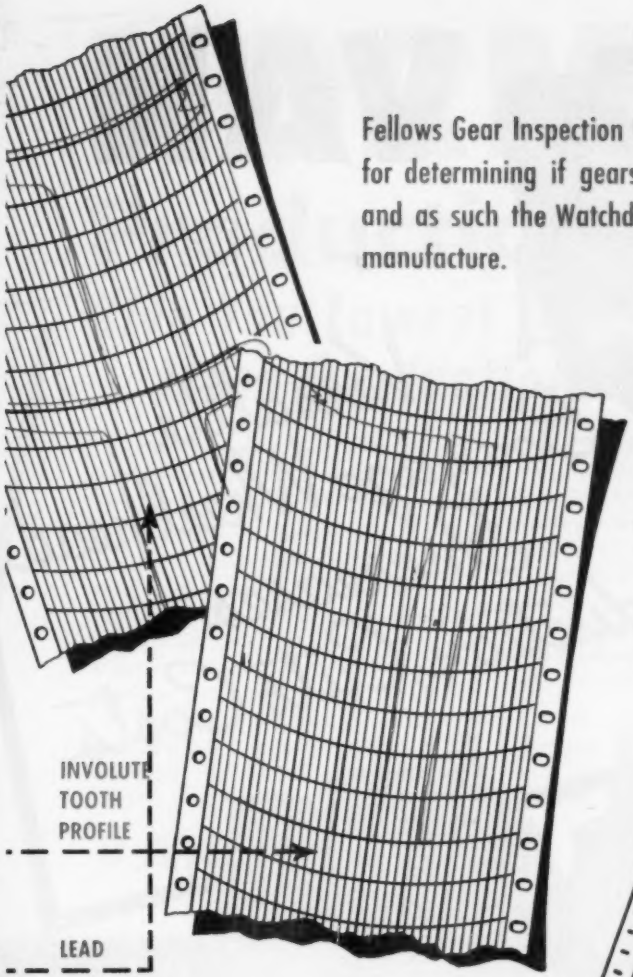
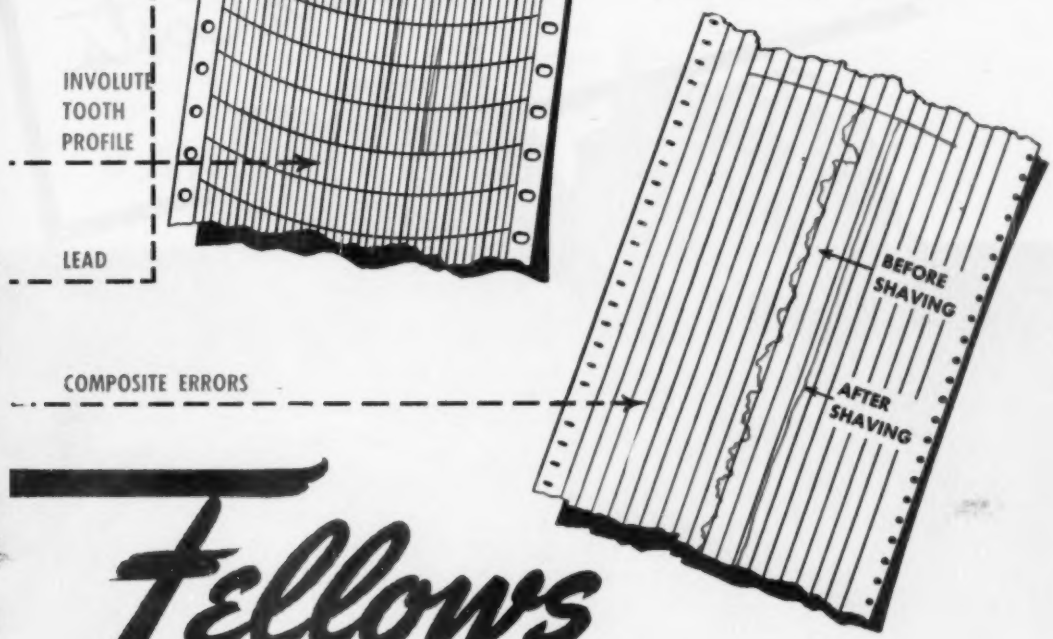
Fellows Gear Inspection Instruments... the necessary means for determining if gears are not within specified limits... and as such the Watchdogs of Cost Dollars in Quality Gear manufacture.

A full complement of Inspection Instruments pays for itself many times over in the losses it prevents. Each of these three instruments has a job to do, and all are essential... ALL produce charted records, incontestible, for analytical study and for permanent filing. You can verify the accuracy of work with errors magnified 200 to 500 times on the Fellows Inspection Instruments Charts.... Literature on each of these Instruments is available, as is also the consulting advice of a Fellows Sales Engineer regularly in your vicinity. Write "Fellows" at the nearest office.





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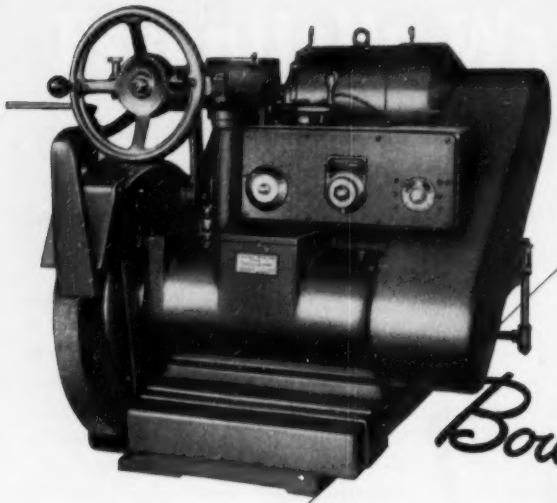
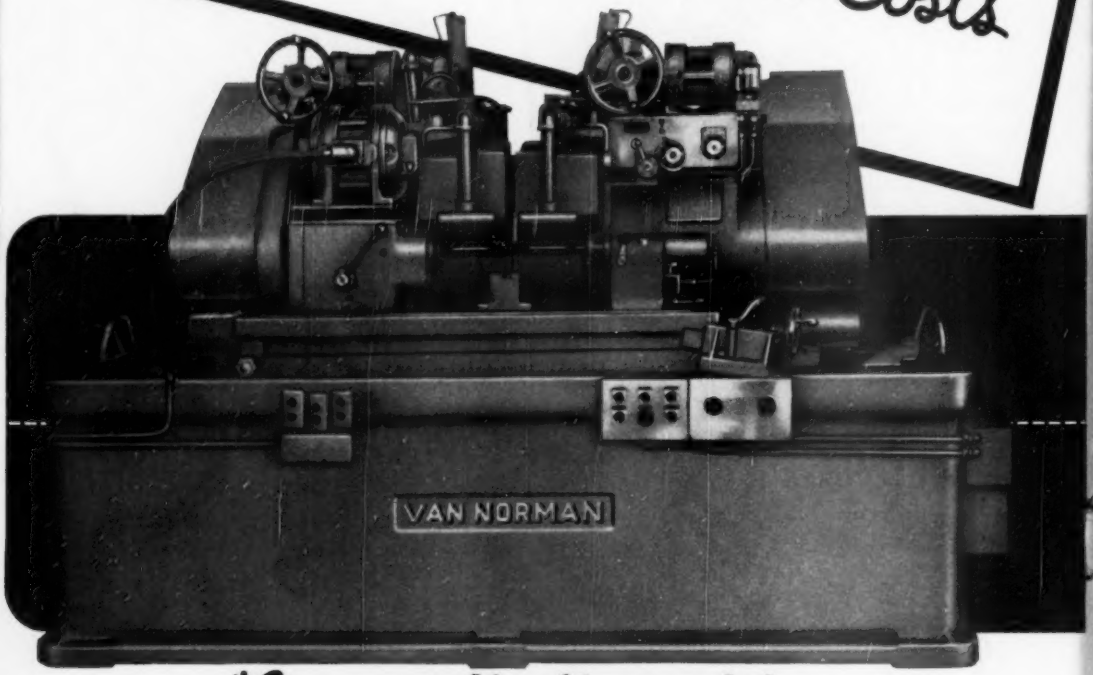


Versatile Bowgage Wheelhead Increases Production, Cuts Costs



"It pays to Van Normanize"

NORMAN
Production Grinders
Give You Lowest Cost-Per-Piece Mass Production Grinding!

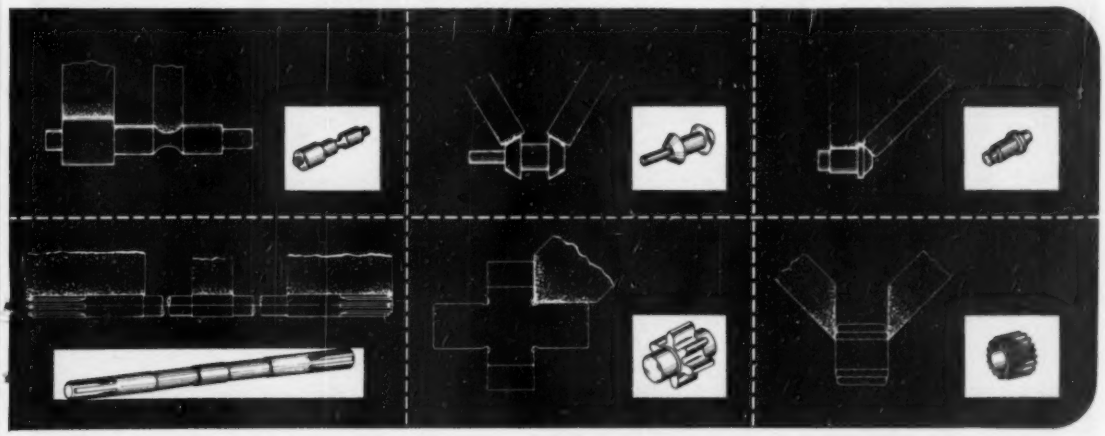
You can increase your production, cut costs of mass production grinding with Van Norman Production Grinders.

These built-for-the-job grinders cut tooling costs, enable you to produce more at the lowest cost-per-piece. By simply taking one or more *Bowgage Wheelheads* and mounting them on a suitable base, there is practically no limit to the number of diameters, tapers, shoulders, etc., that can be ground to close tolerances, automatically. See typical Van Norman grinding applications below.

The *Bowgage Wheelheads* are automatic integral grinding units. They are complete units with gauging, rough and finish feeds, and automatic cycling with rapid traverse. All the operator has to do is load the work piece, push start button and the machine takes over performing all the operations and then stops automatically for removal and reloading of the work.

It will pay you to investigate Van Norman Production Grinders. They will increase production, save time and cut costs. Write for information.

VAN NORMAN COMPANY
SPRINGFIELD 7, MASSACHUSETTS



Typical Grinding Applications Performed by Van Norman Production Grinders

NOW . . . . . 36 PIECES

Other Indirect Savings in

WORLD'S LARGEST EXCLUSIVE MANUFACTURERS OF THREAD

THREADED INSTEAD OF 1

Tool Cost and Tool Inventory

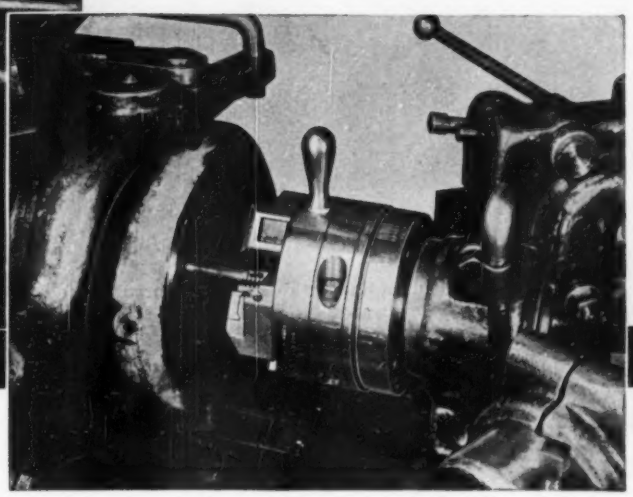
This manufacturer had cut threads on adjusting screws in the past by making several passes with a single point tool. Actual chasing time on the .623 in. diameter 8 pitch thread 1 3/8 in. long was 4.86 minutes.

LANDMATIC Die Heads were installed to perform these operations. Immediate savings were realized when actual threading time was cut to 8 seconds.

LANDMATIC Die Heads are well-suited to cutting these modified square threads. Rigid construction holds the chasers firmly—line contact with the work reduces friction and cutting strains—thus making it possible to produce the thread in a single pass.

Other savings accrued from LANDMATIC Heads. Interchangeable chasers can be re-ground singly, and for over 80% of their length. A single chaser can be replaced in the set. Chasers will maintain a more consistent thread form than a single point tool.

For more information about these cost-cutting tools, write for Bulletins F-80 and F-90.



LANDIS Machine COMPANY
WAYNESBORO, PENNA.

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LESS SETUP TIME—

LANDIS TOOL
Precision Grinders

111 The modern Landis Tool Centerless Grinder.

Request Catalog T-47 for full information and specifications.

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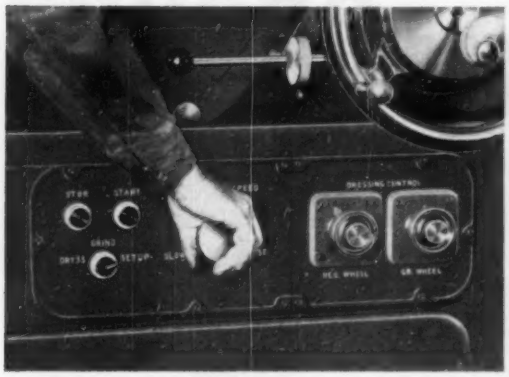
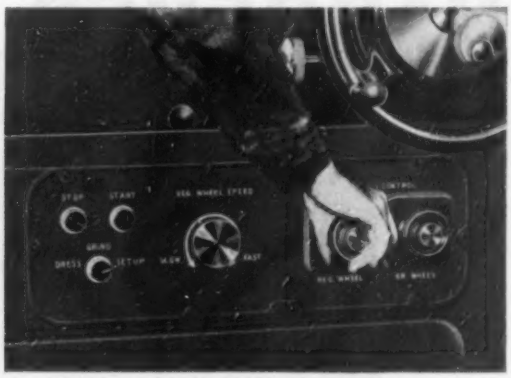
on LANDIS TOOL precision centerless grinders

Cut costs on short run production.
Save time on every job regardless of length of run.



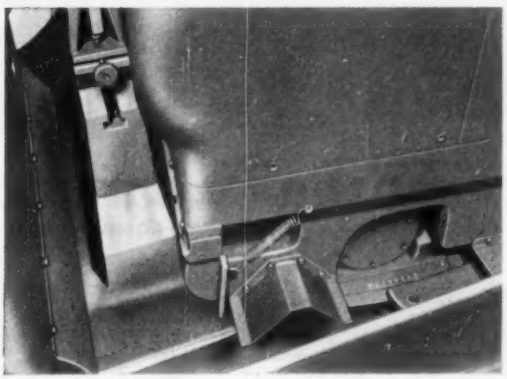
SIMPLE REGULATING WHEEL SPEED ADJUSTMENT— Convenient rheostat control of variable regulating wheel speed 12 to 100 r.p.m. for selection of the right regulating wheel speed.

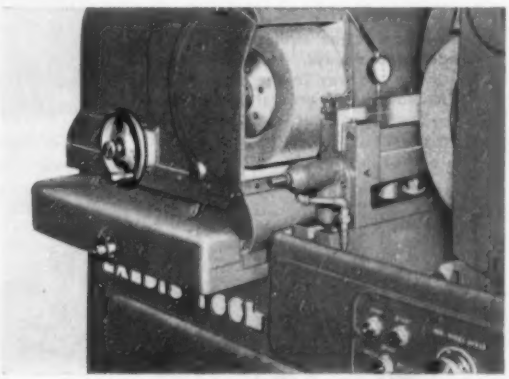
QUICK SETUP FOR GRINDING TAPERS— Swivel regulating wheel base to desired taper angle on calibrated scale. No need to dress taper on wheels; thereby prolonging wheel life.



INSTANT CHANGE TO DRESS REGULATING WHEEL— Turn knob for 300 r.p.m. dressing speed of regulating wheel. No readjustment of regulating wheel speed required.

QUICK CHECK OF WORK BLADE ALIGNMENT— Support indicator on base. Hydraulically traverse base to check work blade alignment with grinding wheel spindle.



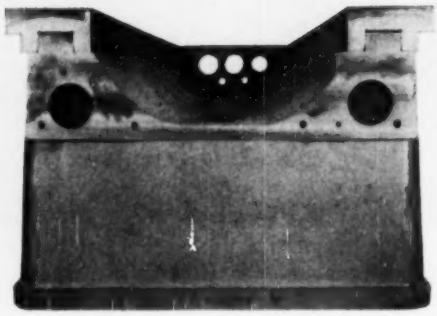


LANDIS TOOL COMPANY • WAYNESBORO, PENNA., U.S.A.

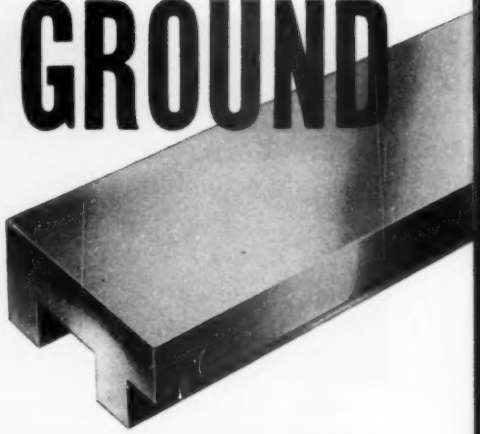
GIDDINGS & LEWIS

now offers

HARDENED and GROUND

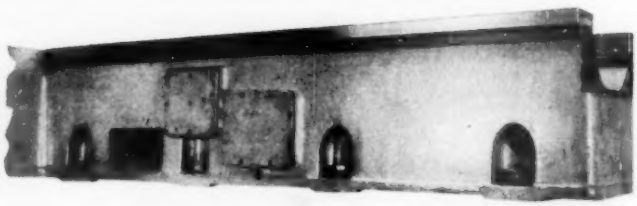


Unretouched photograph of the new G. & L. hardened bed ways. Heat penetration is clearly shown by metal discoloration which indicates the improved bearing surface.



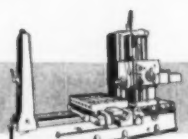
Massive surface hardened ways are jig drilled for dowelling to the machine bed.

G. & L. machine equipped with hardened table ways. Note the dowels locking the way to the machine bed. The dowels are accurately fitted into the holes without excessive driving pressure.

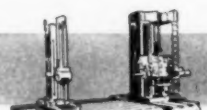


GIDDINGS & LEWIS
FOND DU LAC

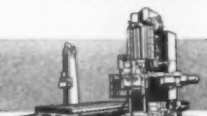
G&L HYPRO



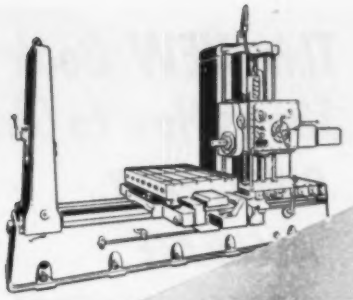
G. & L. Table Type Horizontal Boring Machine



G. & L. Floor Type Horizontal Boring Machine



G. & L. Planer Type Horizontal Boring Machine



WAYS ...ON BEDS, SADDLES AND COLUMNS

PERMIT HIGHER MACHINING ACCURACY OVER A LONGER PERIOD OF TIME; PROVIDE FREEDOM FROM GALLING

To help maintain high machining accuracy over a longer time, G. & L. Horizontal Boring, Drilling and Milling Machines are now available with heavy-duty, surface hardened ways. This important new Giddings & Lewis construction feature can be applied to the bed, saddle and column on most machine models.

The greater hardness of the new ways also provides a remarkable freedom from *galling*, which often occurs when mating surfaces of bearings have a similar degree of hardness. As a result, G. & L. machines equipped with hardened ways are unusually smooth, accurate and economical in operation.

New Hardening Method

Hardening is obtained by means of a new process—recently developed by G. & L. engineers—in which bearing surfaces are hardened to an unusual depth. During the operation, ways are held in a special fixture which duplicates the actual mounting surface used on the machine itself. The ways are precision ground after hardening.

Improved Way Mounting

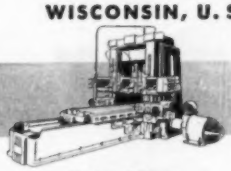
An advanced means of way mounting also contributes to high machining accuracy. This new method serves to minimize transmittal to the ways of torque, strains and shock set up by temperature changes, settling, vibration, etc., from the various machine components.

A tongue on the mounting surface of the machine bed, saddle or runway slip-fits into a channel on the undersurface of the way. For accurate and solid support, however, the way actually rests on hand-scraped shoulders on either side of the tongue. The way is held by double dowel pins inserted into the tongue through the channel.

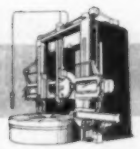
Ask our engineers how G. & L. machines equipped with hardened ways will increase the accuracy of your machined products—and give you years of trouble-free service.

MACHINE TOOL COMPANY

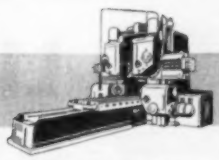
WISCONSIN, U. S. A.



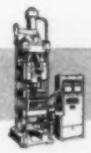
Cincinnati Hypro Double Housing Planer



Cincinnati Hypro Vertical Boring and Turning Mill



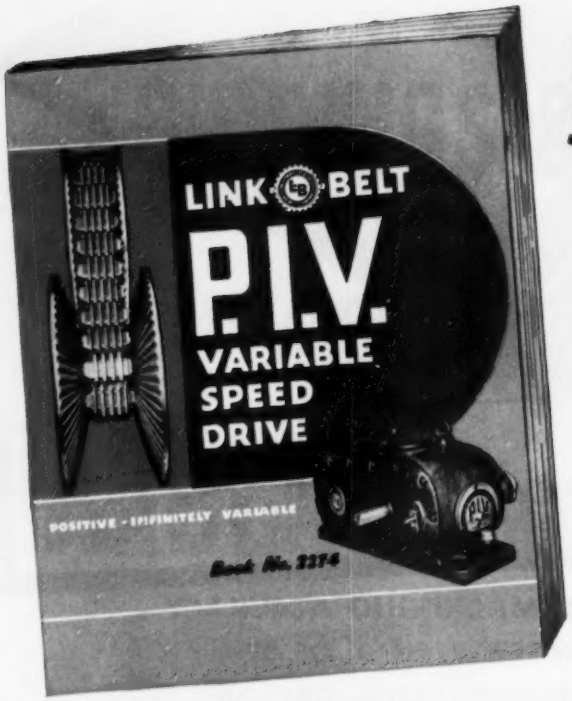
Cincinnati Hypro Planer Type Milling Machine



G. & L. Vertical Plastics Injection Press

DAVIS

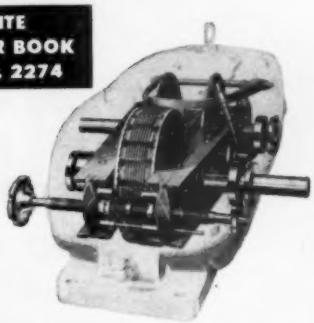
Complete Tooling Service



Pre-selected drives occupy over 25 pages of this entirely new book, making it extremely easy to select an accurate, variable speed drive.

This NEW Book Shows How to Obtain QUICK, EASY, ACCURATE SPEED CONTROL

WRITE FOR BOOK NO. 2274



THERE'S ONLY ONE P.I.V.

Wherever speed is a factor in manufacturing operations or processes, the supremacy of the Link-Belt P.I.V. variable speed drive becomes readily apparent, as a means of providing precise control, instantly variable, and reliably constant over long periods. Power is transmitted from input to output shaft through a *unique chain* which makes *positive* engagement with radial grooves on two pairs of opposed driving wheels. Movement of the control screw simultaneously varies the effective diameters of these wheels. Thus an infinite number of *stepless* speed adjustments is possible between maximum and minimum settings. Because it is entirely independent of frictional elements, the P.I.V. variable speed drive *eliminates slip or creep*, ends costly guess work or hunting and extends the range of operations for greater efficiency and higher production.

LINK-BELT COMPANY

Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Johannesburg.
Offices, Factory Branch Stores and Distributors in Principal Cities.

SIXTEEN TYPES
EIGHT SIZES
1/2 TO 25 H. P.

Available in standard form for vertical or horizontal mounting and with extra input and output gears, also with motor integrally mounted. Ratios up to 6:1.

AUTOMATIC CONTROLS

Link-Belt "Job Engineered" Automatic Controls provide instant, accurate adjustment of output speed, by electrical, hydraulic, pneumatic or mechanical accessory devices. WRITE FOR BOOK 2349.

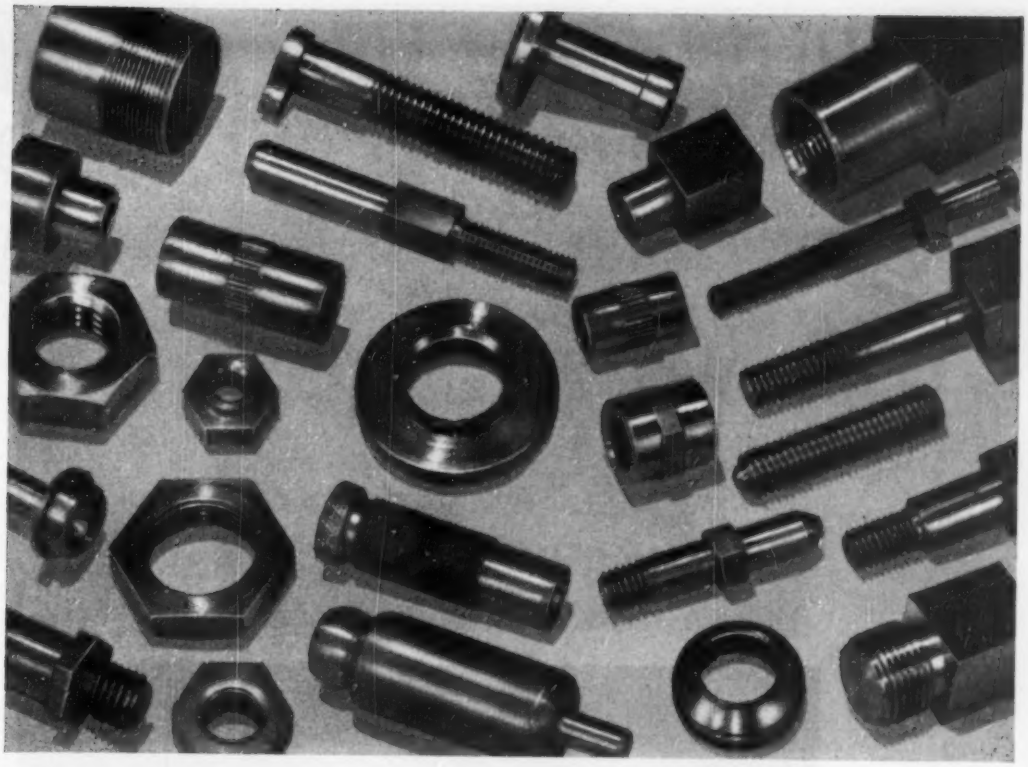
For dependable operation at efficient speed without slip; for positive, infinitely variable control of rotary motion; for rapid speed changing by manual, automatic or remote control, INDUSTRY USES

For dependable operation at efficient speed without slip, for positive, infinitely variable control of rotary motion, for rapid speed changing by manual, automatic or remote control, INDUSTRY USES

11,001

LINK-BELT

P.I.V. Variable Speed Drive



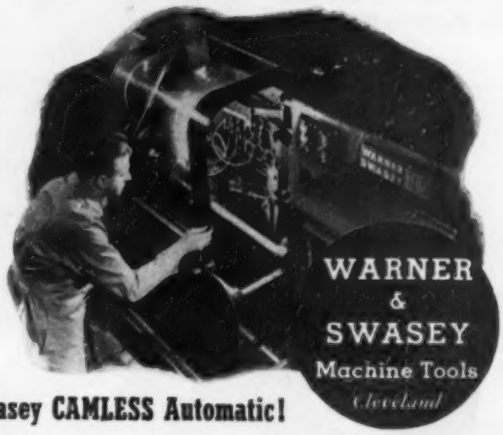
Not a single cam change needed to make all of these parts on a WARNER & SWASEY 5-SPINDLE AUTOMATIC

★ Nearly 300 different parts are produced on a Warner & Swasey 5-Spindle Automatic at Electric Controller & Mfg. Co., Cleveland.

★ *Not a single cam change* is required to produce this variety of jobs.

★ Patented "Quick Set" mechanism eliminates all expense of designing, machining, storing and finding cams, and time-taking setup.

Call your Warner & Swasey field representative.



It's simpler **to set up a Warner & Swasey CAMLESS Automatic!**

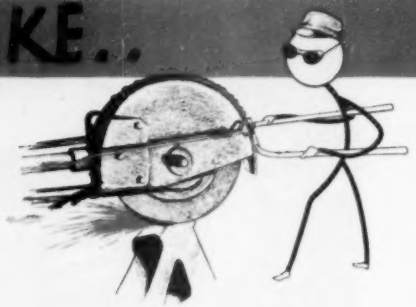
TURRET LATHES, MULTIPLE AND SINGLE SPINDLE AUTOMATICS, PRECISION TAPPING AND THREADING MACHINES

WOULDN'T YOU LIKE..

a wheel that would really snag off metal?

AND

last Forever?



No such wheel has ever been made...

But **we can supply you with wheels that DO offer Maximum Cutting Action and DO have Extra Long Life!**

FAST CUT

If "fast cut" is the primary requirement which spells economy on your particular snagging operations, Norton engineering can furnish you with wheels that fill the bill.

NORTON ABRASIVES

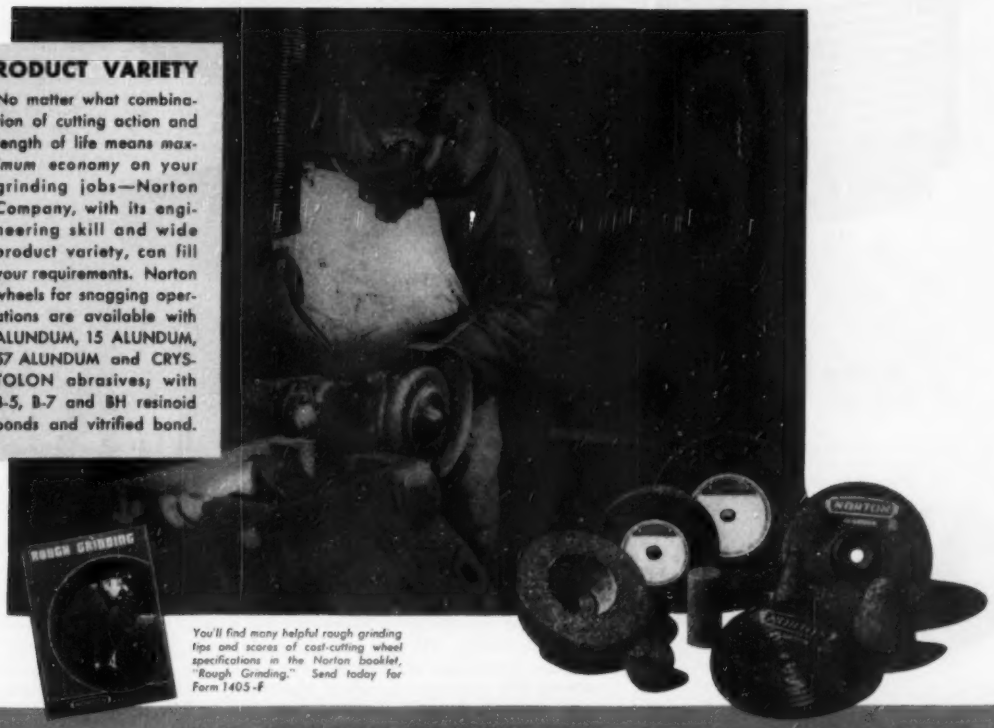
Making better products to make other products better

LONG LIFE

If "long wheel life" is your particular requirement for economy, Norton abrasive know-how can help you to select exactly the right grinding wheels.

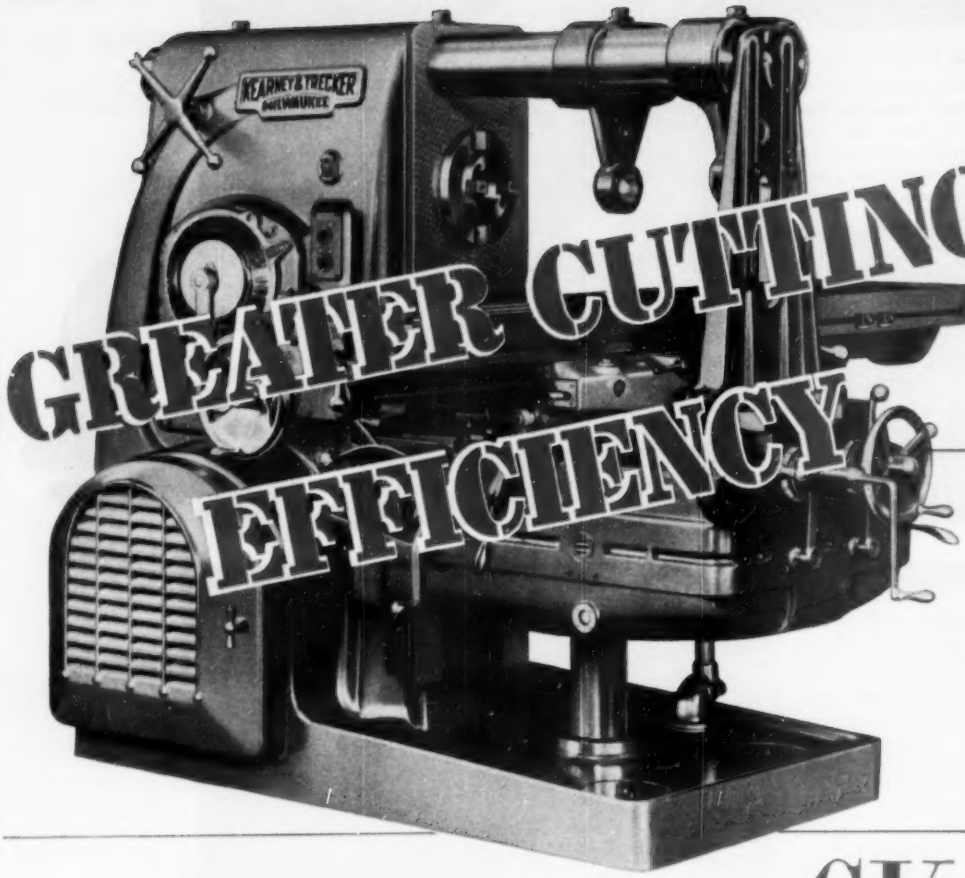
PRODUCT VARIETY

No matter what combination of cutting action and length of life means *maximum economy* on your grinding jobs—Norton Company, with its engineering skill and wide product variety, can fill your requirements. Norton wheels for snagging operations are available with ALUNDUM, 15 ALUNDUM, 57 ALUNDUM and CRYSTOLON abrasives; with B-5, B-7 and BH resinoid bonds and vitrified bond.



You'll find many helpful rough grinding tips and scores of cost-cutting wheel specifications in the Norton booklet, "Rough Grinding." Send today for Form 1405-F

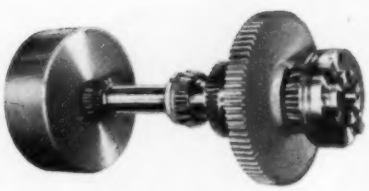
NORTON COMPANY, WORCESTER 6, MASS. • Warehouses in Five Cities • Distributors in All Principal Cities



GREATER CUTTING EFFICIENCY

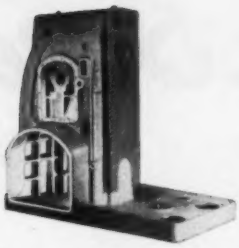
A new line of Knee-Type Milling Machines

KEARNEY & TRECKER MILWAUKEE **CK's**

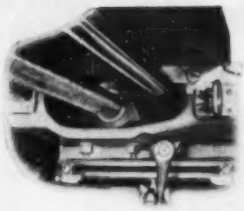


TAKE a look at the "business end" of a new CK milling machine — *the spindle* — with its dynamically balanced flywheel and Kearney & Trecker's famous extra-rigid, three-bearing spindle design. Added flywheel momentum gives you smoother, more positive cutter drive — the key to *Greater Cutting Efficiency* using modern cutting tools. Yes, and you get increased cutter life, too. The three-bearing spindle design affords ample support and greater rigidity — regardless of cutting loads. Heavy duty wide-faced spindle drive gears of forged steel are specially processed for longer life and exceptionally smooth, quiet operation. But this tremendously efficient spindle is only one of many pace-setting CK features. Look at the other features, too. See how they combine to give you the most productive, most profitable milling machines you can buy today — anywhere!

Replacement of obsolete machine tools is an



GREATER RIGIDITY — Yes, these new CK columns are the most rigid milling machine columns we've ever designed! They give you 1000 pounds more metal scientifically distributed in heavier ribbing, box section, sponson construction . . . to effectively absorb vibration from heaviest cutting loads.

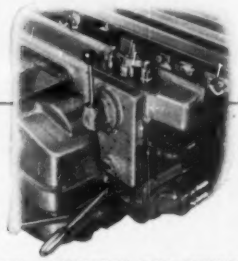


SMOOTHER FEED PERFORMANCE — with a new design 2" diam. heavy-duty, table feed screw that affords greater bearing contact and runs through an extra-long table feed nut. These new CK machines are equipped with a backlash eliminator for more effective climb milling, more accuracy and longer screw life.

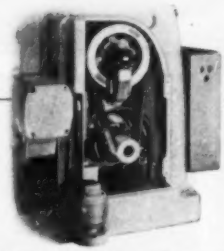
GREATER ADAPTABILITY — No. 60 Heavy Duty drive flange on Nos. 4, 5 and 6 machines enables use of heavy duty arbors with flange drive for large single or multiple cutter setups; or bolting large face-milling cutters directly to spindle nose. Average setups use standard arbors with No. 50 spindle drive.

NON-GLARE RAPID-SET DIALS—You'll avoid costly errors in reading and setting these new micrometer dials. They're vapor blasted to give you a satin surface with high contrast markings. They're easy and quick to set and provide positive lock at every setting.

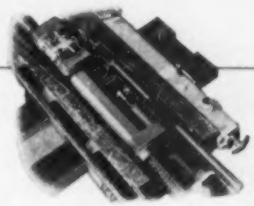
FEEDS AND SPEEDS TO TAKE FULL ADVANTAGE OF MODERN CUTTING TOOLS — and you really can do it with the broad feed and speed ranges on Kearney & Trecker's new CK milling machines. You get 24 spindle speeds (15 to 1500 rpm on Nos. 2 and 3, 13 to 1300 rpm on Nos. 4, 5 and 6) with Kearney & Trecker's automatic protecto-mesh shift to eliminate gear clashing. And there's the extra-wide feed range — 32 changes from ¾" to 90" per minute—with separate 3 or 5 hp feed and rapid traverse drive.



GREATER PRODUCTION AND GREATER OPERATING CONVENIENCE—Production men will like Mono-Lever Control because it reduces idle cutter time, shortens floor-to-floor cycle time on both long and short run lots. Operators will like it because it makes faster, simpler, less fatiguing work for them.



GREATER HORSEPOWER — where you need it. That's what you get with new CK independent motor drives for spindle and for feed and rapid traverse. Depending on machine size (Nos. 2, 3, 4, 5 or 6), machines range from 10 to 25 hp for spindle drive and 3 to 5 hp for feed and rapid traverse.



GREATER MACHINE LIFE — through automatic lubrication and generously proportioned gears and shafts throughout for overload conditions. There's a forced flood system in the column and knee, and a positive metered, pressure pump system for table, saddle and knee ways, and table feed assembly.

Kearney & Trecker's new CK line of knee-type machines is designed to meet every demand of present-day milling . . . making them more accurate, and MORE PRODUCTIVE for you. Contact your Kearney & Trecker representative or write direct to obtain their complete specifications. Find out how CK machines easily replace obsolete machines at substantial savings to you. Kearney & Trecker Corp., 6784 W. National Ave., Milwaukee 14, Wis.

investment that makes Dollars and Sense.

Maytag ....Saves

This round aluminum tub was formerly finished by set-up wheels in the MAYTAG plant. METALITE Belts now do the job, cutting 50% faster, lasting 3 times as long, getting out 60 to 65 units per belt.

In finishing this MAYTAG square aluminum tub, METALITE Cloth Belts boosted production from 20 per set-up wheel to from 80 to 105 per belt, plus faster production.

Thousands of Dollars
with METALITE® BELTS !

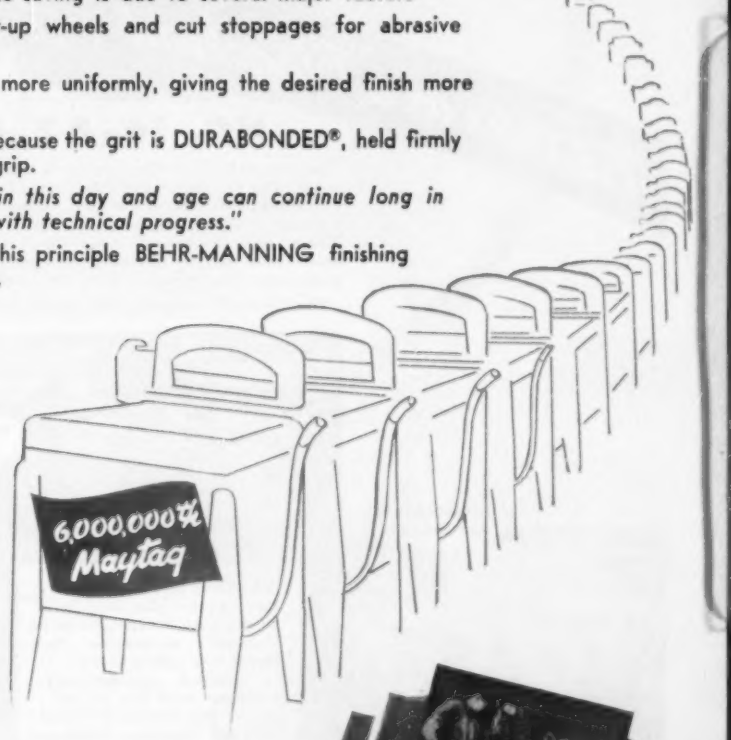
IN VITAL FINISHING OPERATIONS this huge and notably successful organization estimates a saving of up to $25,000 yearly in switching from set-up wheels to Behr-Manning METALITE Cloth Belts and back-stand idlers for operations such as those pictured on the opposite page.

As in numberless other cases, the saving is due to several major factors—

1. METALITE Belts outlast set-up wheels and cut stoppages for abrasive renewal way down—
2. METALITE Belts cut faster, more uniformly, giving the desired finish more quickly—
3. METALITE Belts cut longer because the grit is DURABONDED®, held firmly to the work, in an unyielding grip.

Says MAYTAG, *"No industry in this day and age can continue long in existence unless it keeps pace with technical progress."*

In the plants which adhere to this principle BEHR-MANNING finishing methods are most often found.



LARGEST WASHING MACHINE MANUFACTURER celebrated within recent months, the completion of the 6-millionth MAYTAG washer. Besides washers, the MAYTAG Company, Newton, Iowa, makes a number of other electrical appliances, including electric ironers, gas ranges, and home freezers. As in the case with so many up-to-date manufacturers, BEHR-MANNING belts are relied upon for all kinds of finishing operations.

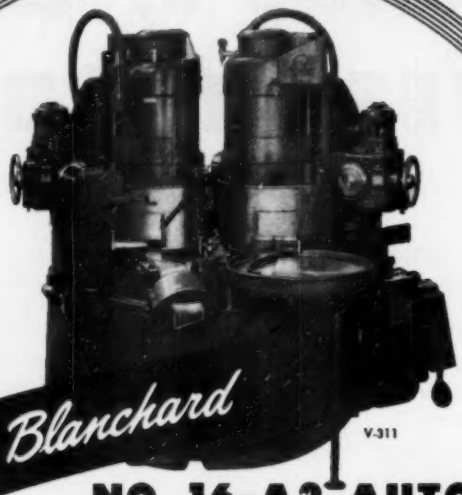
THIS NEW BULLETIN tells you how you can easily see and try BEHR-MANNING belt grinding and polishing in a nearby, completely-equipped Methods & Equipment Demonstration Room. Write today for Bulletin AM-10.

BEHR-MANNING®

BEHR-MANNING

TROY, N.Y.

Use NORTON® *abrasives sharpening stones*

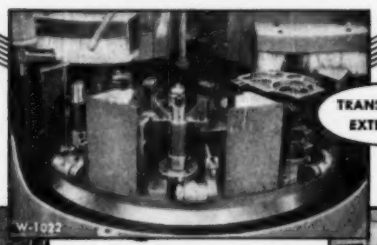


Put them on a Blanchard

NO. 16-A2 AUTOMATIC

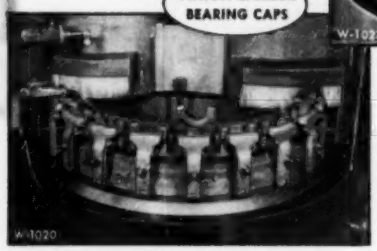
This two-spindle surface grinder is a real producer. In a single pass, the work is roughed by one wheel and then finished by the second wheel. Because each wheel can be selected for its part of the grinding operation, without having to compromise between roughing and finishing, the No. 16-A2 is particularly suited to work requiring high production. Close limits are assured by automatic size control for each wheel. If you're looking for maximum results with minimum effort, get production details on just how fast your own work can be done on the No. 16-A2.

Send blueprints or samples — there is no charge or obligation.



TRANSMISSION EXTENSION

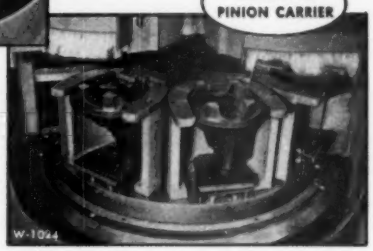
PINION CARRIER BEARING CAPS



These cast iron caps are placed in suitable stations, automatically clamped, ground, and automatically unclamped. 1020 caps per hour are ground to ±.003", and flat to .002" in a 20 station fixture. 1/16" of stock is removed per side.

The joint face is ground by loading the cast iron part over a post, locating from a shoulder, supporting the flange by a spring bunter. It is clamped automatically. Parts are held flat to .001", square with bore to .002", and to ±.001" for size. 84 pieces ground per hour on one side.

REAR AXLE PINION CARRIER



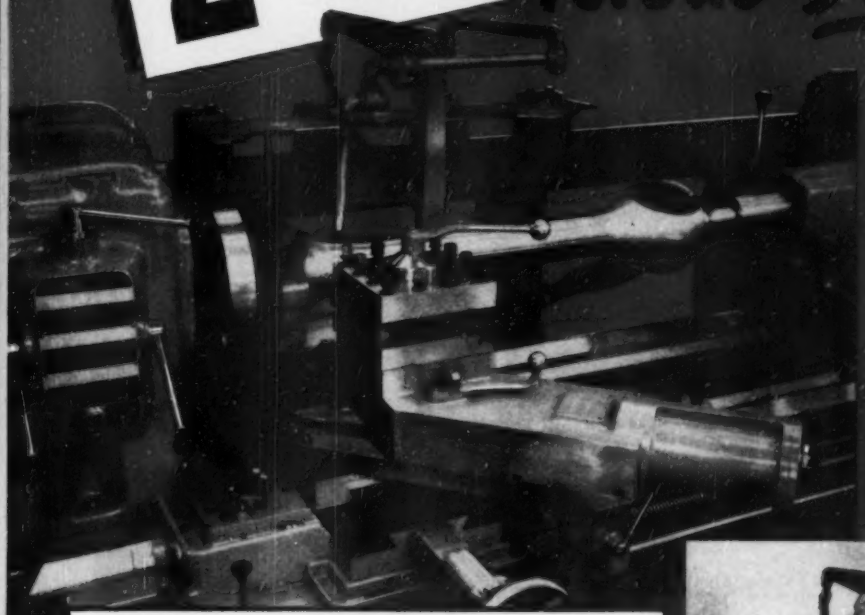
These cast iron parts are loaded with the flange under a "U" shaped block, clamped upward against the block. The four bearing surface "feet" are ground to limits of ±.003", parallel to flange within .001". 229 pieces are ground per hour on one side.

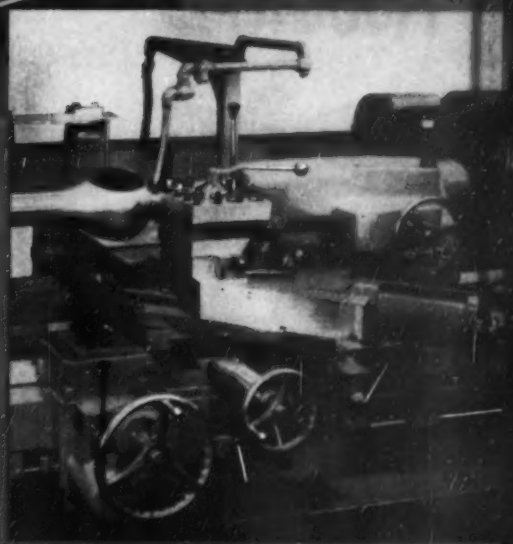
Send for your free copies of "Work Done on the Blanchard," third edition, and "Art of Blanchard Surface Grinding."

PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE COMPANY 64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.

2 hrs. versus 9½ hrs.





This marine Diesel engine connecting rod is now roughed and finished from the rough forging in exactly 2 hours. It formerly required 9½ hours to do the same job.

With production costs constantly reaching new peaks, industry simply can't afford to ignore such savings from modern equipment. Where else could such a magnificent return upon an investment be secured, and how else can costs be lowered to meet an increasingly competitive market?

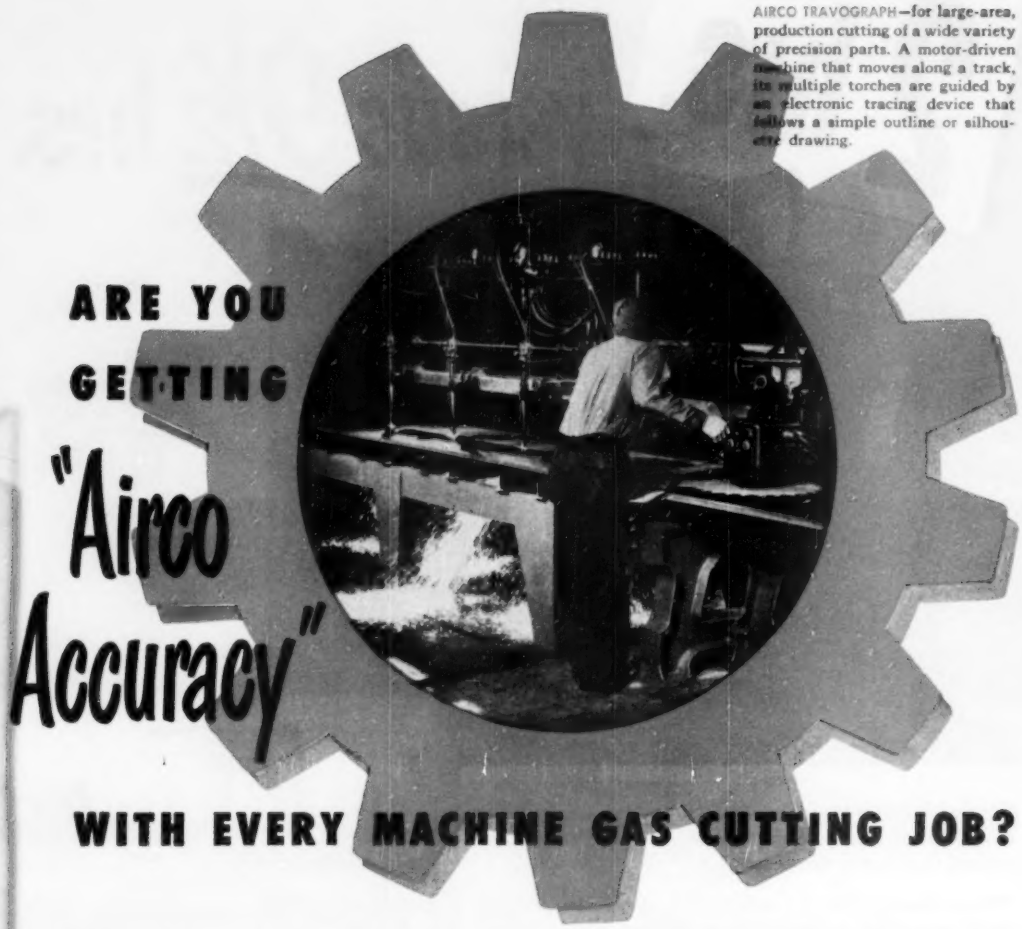
More production per man hour is the answer and the only answer to prohibitive costs—modern, high production machinery is the answer to greater production per man hour.

The astounding saving on this connecting rod job is the result of transferring it from previous equipment to a new 32-inch "AMERICAN" Hydraulic Duplicating Lathe. Such savings as this are not the exception but the rule when "AMERICAN" Duplicators are put on the job.

Bulletin No. 35 shows many such examples—it's yours for the asking.

THE AMERICAN TOOL WORKS CO. **Cincinnati, Ohio U.S.A.**

Lathes and Radial Drills



AIRCO TRAVOGRAPH—for large-area, production cutting of a wide variety of precision parts. A motor-driven machine that moves along a track, its multiple torches are guided by an electronic tracing device that follows a simple outline or silhouette drawing.

ARE YOU GETTING "Airco Accuracy" WITH EVERY MACHINE GAS CUTTING JOB?

Whatever your steel cutting problem—from squaring and shaping of large plates and heavy slabs to quantity, precision-cutting of small steel parts—there's an Airco Gas Cutting Machine that's just suited to your needs . . . designed to do the work faster, better, at lower operating cost.

Airco Gas Cutting Machines are made in portable and stationary types, for single or multiple torch operation—all embodying characteristic Airco accuracy, rugged construction and excellent operating performance . . . insuring long, trouble-free life under heavy service loads.

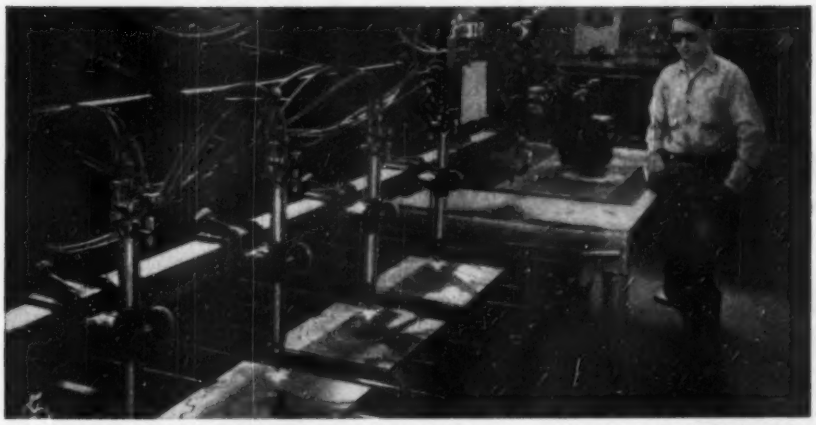
Three separate and distinct tracing devices help give the Airco machines their great flexibility and accuracy: manual, magnetic and the fully-automatic "Electronic Bloodhound." With the "Electronic Bloodhound," cuts of the most intricate shapes can be made easily to specified close tolerances.

From an 8-torch Travograph, equipped with an electronic tracing device, to the portable No. 3 Monograph, each Airco Gas Cutting Machine performs a wide variety of cutting jobs within its specific operating range . . . an important feature that has made Airco Gas Cutting Machines outstanding in the metal-working industry.

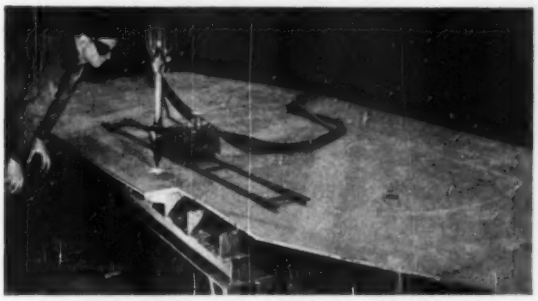
So, for economy, speed, and accuracy, investigate the possibilities of using any one of the numerous Airco Gas Cutting Machines—select the one best suited to your needs. Please write your nearest Airco office for full details.

AIRCO **AIR REDUCTION**
Offices in Principal Cities
Represented Internationally by Airco Company International

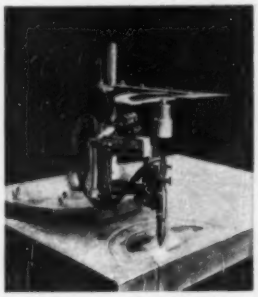
AIR REDUCTION . . . PIONEER



AIRCO OXYGRAPH — one of the most popular stationary shape cutting machines ever offered. Designed for single or multiple torch operation, identical parts of any design are accurately shaped in one operation — either by "stack" cutting or an individual cutting operation.



AIRCO No. 10 RADIAGRAPH — a lightweight, portable, motor-driven machine that is ideal for straight line cutting, squaring, beveling and similar cutting jobs. It cuts arcs and circles up to 85" in dia.



AIRCO No. 5 CAMOGRAPH — ideal for repetitive cutting of small shapes. It cuts parts of any contour by means of a motor-driven magnetic roller that follows the template itself. This controls the torch movement, and assures speedy, accurate cutting.

AIRCO No. 3 MONOGRAPH an inexpensive, portable shape cutting machine. Designed for straight line, circle and bevel cutting jobs in addition to irregular shape cutting—all with a high degree of accuracy. The machine is easily moved from job to job — weighing only 110 lbs.

DESIGNERS OF FLAME CUTTING MACHINES FOR EVERY PURPOSE

SOMETHING SNAPPED
once too often ....then

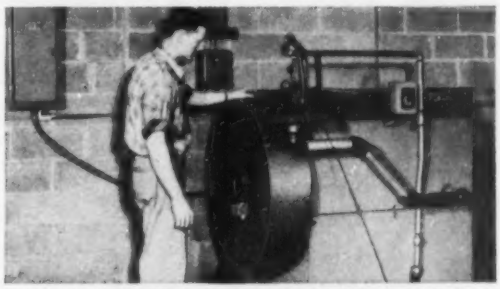
OPERATOR CONVENIENCE is enhanced by placing speed control of G-E Speed Variator near this vertical bull block.

GENERAL ELECTRIC

646-5

Bishop Co. tried adjustable-speed drive and set new production records!

G-E "PACKAGED" SPEED VARIATOR has a 4 to 1 speed range for drawing platinum wire on a vertical bull block.



G-E TYPE ACA MOTOR with a 3 to 1 speed range drives horizontal bull block, brings machine up to speed without "snapping" stainless-steel tubing.

WHEN you're drawing wire and tubing thinner than a human hair, frequent breakage can be a major headache. At least it was for the J. Bishop Company until electrical adjustable-speed drive came to the rescue.

If a drawing or spooling machine drive came up to speed too fast, "SNAP"—another die had to be changed. Or, if the equipment was operated slowly, production was severely limited.

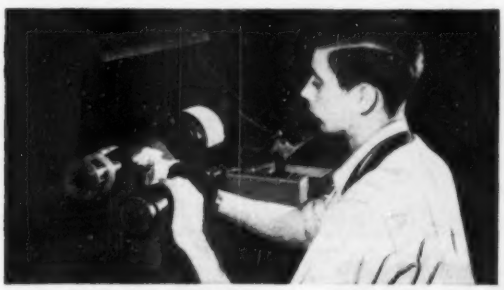
Finally, "something snapped" once too often—and General Electric adjustable-speed drives were selected for the different types of machines. A G-E Speed Variator with a 4 to 1 speed range was installed on a vertical bull block. Result? One simple drawing operation instead of the complicated swaging and multiple-die drawing formerly required. Next, a G-E Type ACA motor with a 3 to 1 speed range was put on a horizontal bull block, drawing stainless steel tubing. Production jumped from 28 fpm to 120 fpm. Finally a platinum spooling machine was equipped with a G-E Thy-mo-trol* drive. Jerking and breaking are rare now and the spooler can handle any diameter from .001 to .020 inch, thanks to the 20 to 1 speed range of the Thy-mo-trol drive.

Chances are you, too, stand to gain from an efficient application of *electrical adjustable-speed drive* somewhere in your plant. To help you profit from these opportunities, we suggest you do the following:

1. Send for our 24-page bulletin (GEA-5334), "Getting The Most Out Of Your Machines."
2. Call in a G-E engineer to help you with application details.
3. Keep in mind that General Electric can offer you *all* types of electric adjustable-speed drives in speed ranges of 3 to 1 to 50 to 1.

Apparatus Department,
General Electric Company,
Schenectady 5, New York.

*General Electric Co. registered trademark for electronic drive.



G-E THY-MO-TROL DRIVE operates platinum-wire spooling machine over 20 to 1 speed range, replaced drive which lost power at slow speeds.

GENERAL ELECTRIC
Headquarters for
Electrical
ADJUSTABLE - SPEED DRIVES

Get All-Around Motor Protection with

SAFETY-CIRCLE

THAT SOLID CAST IRON FRAME protects *Safety-Circle* working parts against physical damage from every angle. The completely enclosed bottom provides extra protection and extra strength. End brackets are drip-proof at no premium.

Because the frame is cast iron, it is resistant to rust and corrosion. It withstands physical abuse and will not distort.

Protected Inside, Too

Safety-Circle protects against internal breakdown with multiple-dipped and baked stator and die-cast aluminum rotor. *Ball bearings are factory-lubricated and need no attention for years.* Wide open internal construction and large fans keep temperatures well within rated limits.

Don't be satisfied with a motor that gives you less than full protection. Insist on the extra protection of *Safety-Circle*.

For complete details on *Safety-Circle* advantages, see your A-C Authorized Dealer, Sales Office, or write for Bulletin 51B6210B. Sizes from 1 to 20 hp, 326 frames and smaller.

A-3145

Safety-Circle, Texrope and Vari-Pitch are Allis-Chalmers trademarks.

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MILWAUKEE, WIS.

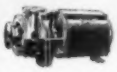
ALLIS-CHALMERS

Sold . . .
Applied . . .
Serviced . . .

by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

TEXROPE — Belts in all sizes and sections, standard and *Vari-Pitch* sheaves, speed changers.



PUMPS — Integral motor and coupled types from ⅝ in. to 72 in. discharge and up.

Production Pointers from GISHOLT

COST CUTTING IDEAS

Gisholt—A Unique Service in the Machine Tool Industry. Here you obtain unbiased help on your turning problems, because Gisholt's broader range of equipment includes both manually operated turret lathes and automatic lathes. Gisholt's recommendations are made without prejudice for one type of machine over another.

MULTIPLYING PRODUCTION PER MAN TO MEET TODAY'S NEEDS

One Man Operates Battery of 4 Machines

Tens of thousands of these bevel ring gears are needed by a large automobile manufacturer. And they're needed fast—at lowest cost.

This four-machine setup with one operator is the job-winning combination—two No. 12 Hydraulic Automatic Lathes, one 2F Fastermatic Automatic Turret Lathe and one broach.

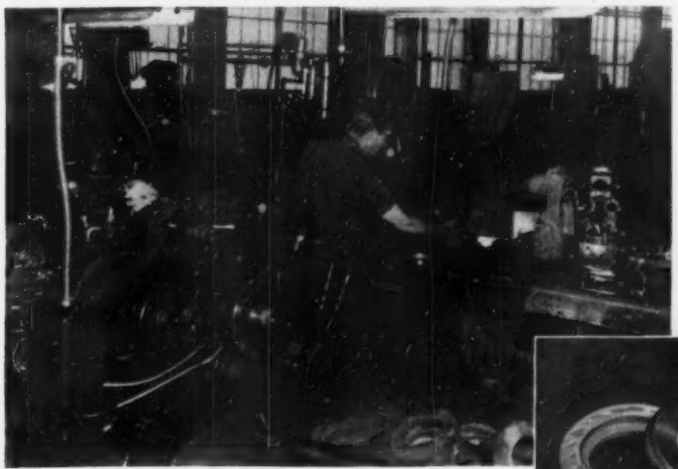
Four operations are required to finish an 8¼ inch bevel ring gear. Floor to floor time for these is a quick 1.75 minutes. The first operation is on a No. 12 Hydraulic—boring a 5¼ inch hole, facing the back side of the gear blank and chamfering both the OD and ID. The second operation is broaching the bore to size.

Fastermatic Completes Fast Job

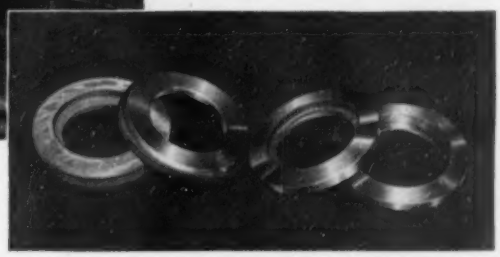
For the third operation, the part moves to the other No. 12 Hydraulic. Held in a fixture, the face and face angle are turned and chamfered. The gear then goes to a 2F Fastermatic for the final operation. A Gisholt 3-jaw air chuck holds it on the OD while the web is faced from the cross slide and then cleaned up from the turret. Additional turret stations do boring, counterboring, facing and chamfering to completely finish the gear in record time.

This manufacturer is mighty happy with his high production rate obtained with a single operator. And this flexible setup permits handling fifteen different sizes of bevel gears on these same four machines.

The two different types of automatic lathes on this job illustrate again the unbiased assistance you can expect from Gisholt. Because this line includes a full range of automatic lathes, as well as manually operated lathes, recommendations of the *right* machines for your needs are made without prejudice.



This team of one man, two No. 12 Hydraulic Lathes and one Fastermatic Lathe produces bevel ring gears at 35 an hour rate.



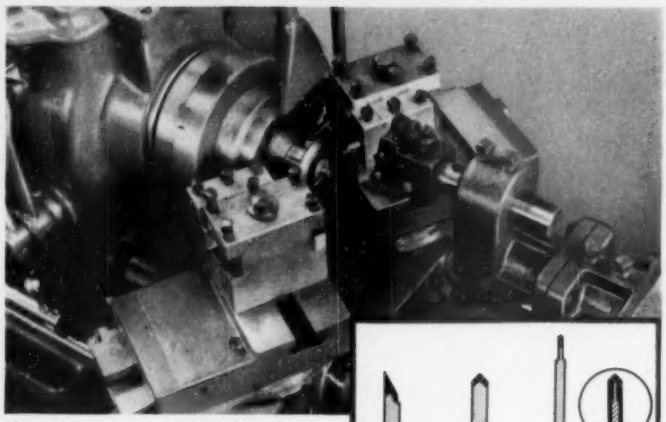
From rough forging through 4 stages of machining on 4 machines takes 1.75 minutes, floor to floor.

MACHINING OF BEVEL OR ANGULAR SURFACES SIMPLIFIED

Special Carriage on Ram Type Turret Lathe Saves Time—Money

Here's an example of a tough job made easy through the simple adaptation of a Gisholt Ram Type Turret Lathe.

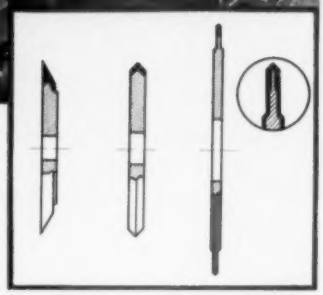
The parts to be machined are circular files of various sizes, requiring accuracy and extremely smooth finish. Worst problem is that the discs of very high carbon tool steel are annealed to "dead soft" with the result that metal tears on the cutting edge of tools. This makes forming or shaving cuts on beveled surfaces impractical.



Showing arrangement of swivel slides on carriage to permit efficient application of single point tools.

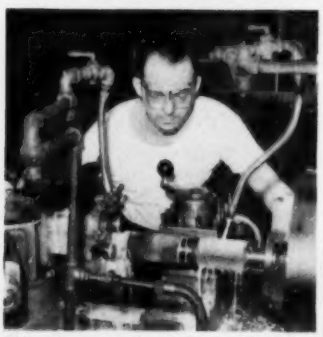
Licked with Single Point Tooling

The special carriage shown at right replaces the standard cross slide carriage and is equipped with two swivel mounted compound slides at front and rear. Readily adjusted to make any desired angular cut, these swivel slides are actuated by push bars from the turret ram, which engage racks in the slides, transmitting power feed. Straight turning of the OD is done by a plain overhead turning tool mounted on the turret. Thus, in a single pass, the straight turning of the OD is accomplished together with the machining of two different angular surfaces on the front and back faces, and the desired shapes are generated with single point tools. This avoids shaving or plunge cut forming tools, which are more difficult and costly to make and maintain. Thus, a Gisholt Ram Type Turret Lathe serves as a special machine with only a minor modification. Time and cost savings are tremendous. Yet, it can be easily converted back to a standard machine with its universal cross slide carriage to perform conventional type work.



Three different sizes and types of file discs, showing beveled surfaces machined on front and back faces.

PRODUCTION DOUBLED WITH STANDARD TURRET LATHE AND STANDARD TOOLS



This setup of standard tools on a 2L Saddle Type Turret Lathe cuts machining time in half.

8 minutes and this forging is a finished flanged countershaft.

Well-Planned Tooling, High Operating Speeds Provide the Answer

These big flanged countershafts are really given the rush act! Before switching to a standard 2L Saddle Type Turret Lathe, a quarter hour per part was the best time available on existing equipment.

Wise production men figured this better way—and without any fancy special tooling. Now, on a standard machine and with simple standard tools, floor to floor time has been reduced to a mere 8 minutes.

High Speed Cutting

Faster cutting speeds also contribute to this increased production. The 2L Turret Lathe has the power to work all tools to their maximum capacity. Machining is done simultaneously from both the hexagon turret and the square turret.

Twelve surfaces are turned, faced and chamfered on the 2L Turret Lathe (centering and machining of flange end are previously done). The shafts are 16½ inches long and come to the job as rough forgings heat treated to 270 Brinell.

WORTH OUT OF MAN-HOURS

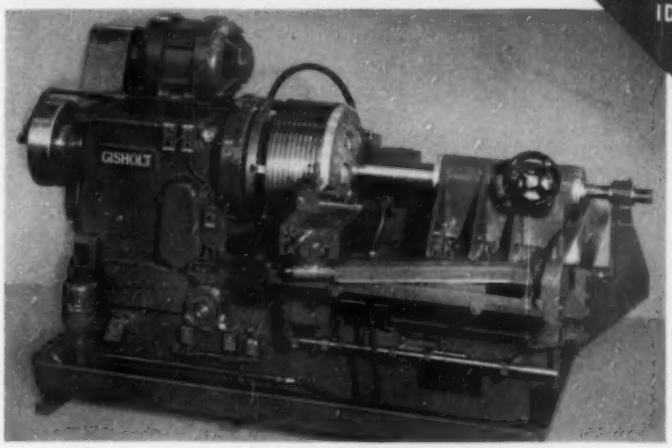
GISHOLT COST CUTTING IDEAS

RAPID CYCLING OF SIMPLIMATIC PAYS OFF ON SHEAVE JOB

Machines Grooves One at a Time!

Very high quality standards are one reason for using this method—rather than multiple tooling. With this method it is possible to avoid excessive tool pressure and heat, which may come from plunge feeding a number of tools into the work. This permits operating at the most efficient cutting speeds and feeds without chatter.

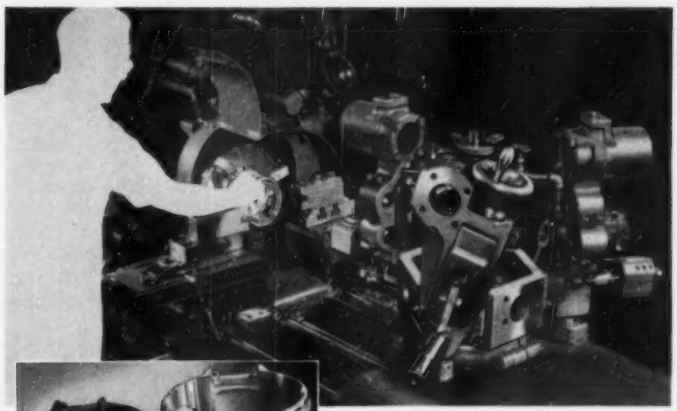
Quick changeover is another "plus" value of this Simplimatic Automatic Lathe. Single tools on the front and rear slides successively rough out and finish the grooves. Any number of grooves of a given diameter may be quickly set by adjusting the ratchet-bar. By indexing the ratchet-bar groove spacing is changed. By cranking out the slides you change the working diameter. Here is a machine with a fast automatic cycle. With a minimum of changeover time you handle A, B or C sheaves. You can accommodate sizes from 10 to 20 inches in diameter and machine from 2 to 12 grooves, all automatically.



A simple machine for top-quality grooving on sheaves of all sizes.

If you would like to know more about this job, contact your Gisholt representative. If you want to know more about the machine, write for the Simplimatic catalog.

FRAGILE PART GETS EASY TREATMENT (BUT FAST!) ON FASTERMATIC



Fastermatic setup for turning generator brackets.

Generator frame before and after machining.

This job—and many others—is shown in the Fastermatic Machine Catalog. Tools for adapting your present Fastermatic to new work are shown in the 136-page Fastermatic Tool Catalog. Write on your company letterhead for both copies—they're free!

Tricky problems faced production men in the machining of these generator brackets: First, the parts were lightweight, fragile and subject to distortion. Second, maximum speed was necessary to get costs down.

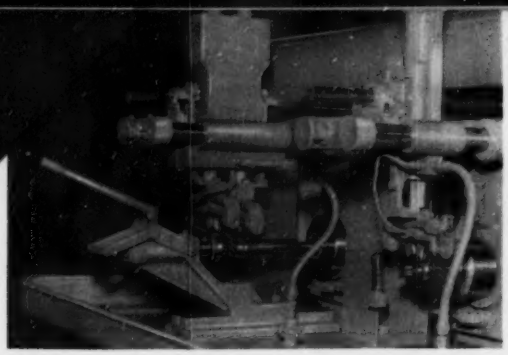
The job was put on a 2F Fastermatic Automatic Turret Lathe, equipped with quick acting draw-back clamps which impose no springing or distortion on the work in the line of any critical dimensions. The tool setup worked out gives a floor-to-floor time of 5½ minutes for the complete machining of 7 surfaces with only one dimension having a tolerance of .010 and all others from .002 to .0003. Four turret stations are used, with the required feed changes made automatically.

The operator only loads and unloads the machine. The entire operation of the Fastermatic is automatic.

UNDER-PAR EFFICIENCY...*REPLACE NOW!*

GISHOLT

COST CUTTING IDEAS



This Model 54-A Two-Spindle Superfinisher is cutting production costs and adding quality on this transmission gears job.

The 2 transmission parts being Superfinished. The long clutch shaft has a 7° taper on the end bearing surface.

SUPERFINISHING OF TRANSMISSION GEARS CUTS COSTS AND TROUBLES..

Here's an automobile builder who shifted into high production on transmission parts with the help of Superfinishing. But more important were the higher quality and lower costs made possible. Conventional grinding was the old method of finishing these vital parts. But this wasn't good enough. Accuracy and smoothness were not up to requirements. Rejects were common.

This Model 54-A Two-Spindle Superfinisher was brought into the picture. This handles two different transmission parts, both 4640 fine grain forgings which are previously ground to 15-20 micro-inches. One operator handles loading and unloading of both spindles—the complete cycles are automatic.

The second speed gear (shown in operator's left hand) is held with a special plate fixture, and the single bearing surface is Superfinished. The long shaft is held in the other spindle by a lever-operated tailstock, and two bearing surfaces are Superfinished by a special stone-holder. The Superfinisher brings down the bearing surfaces from 15-20 micro-inches to 2-3 micro-inches at a production rate of 30 to 40 parts per hour *per spindle* at 80% efficiency.

This Superfinishing operation has not only cut production costs and rejects . . . but has increased quality with the parts, providing better service because of longer wearing surfaces.

This Gisholt Type S quickly and accurately measures and locates dynamic unbalance in the parts of Pope's Spindles and in complete assemblies.

MOTORIZED SPINDLES GET LONGER LEASE ON LIFE THROUGH BALANCING

Vibration Taken Out—Better Performance Put In

The Pope Machinery Corporation of Haverhill, Massachusetts, long-time manufacturer of precision motorized and belt-driven spindles, is widely known for the quality of its products. Its line includes a wide variety of precision spindles for various types of machine tools and other uses.

A vital operation in the manufacture of the spindles, to assure smooth operation and long life, is the dynamic balancing of all rotating parts on Gisholt Balancing Machines. These are balanced in advance of assembly. After all parts have been assembled in final form, the complete spindles are then again balanced dynamically under service conditions.

Gets Maximum Smoothness

Mr. Lyman B. Pope, President, has this to say about the part Gisholt balancing plays in the production of their spindles: ". . . to assure the maximum degree of smooth operation that users expect and get in Pope's Precision Spindles, they can be taken care of only by this final correction on the Gisholt Balancing Machine."

An interesting 36-page booklet on balancing may be obtained free by writing on your letterhead.

DYNETRIC BALANCERS GISHOLT

No. 1050

The Gisholt Round Table represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

GISHOLT

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

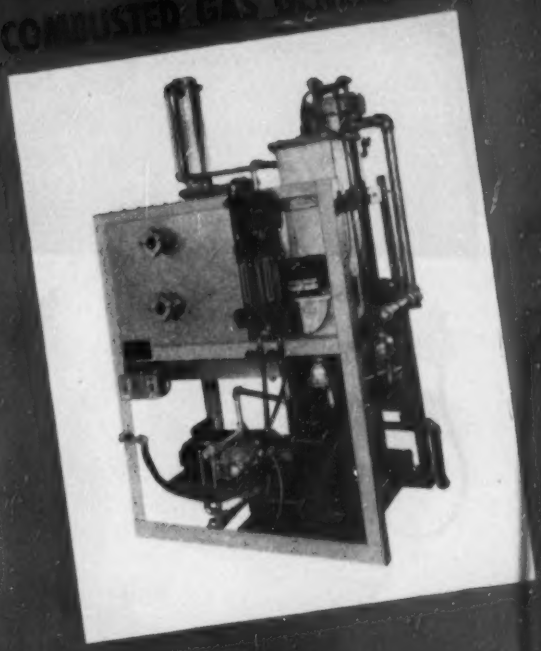
A general catalog on machines listed below is available on request.

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

See them at the Chicago Show

New Hayes AMMONIA DISSOCIATOR

New Hayes COMBUSTED GAS GENERATOR



ELECTRIC CERTAIN CURTAIN FURNACES

Hydrogen atmosphere at 80% saving

This newest Hayes Dissociator has a marked increase in efficiency, giving higher dissociation with less heat required. Using either liquid or vapor ammonia, the AD Model Dissociator produces dry, oxygen-free hydrogen atmosphere at about 1/5 the cost of bottled hydrogen. Atmosphere is ideal for annealing, sintering, soldering, brazing and bright annealing of stainless steels with particular application to radio tube work. Features include: rectangular shape with provision for servicing elements without dismantling; dual intake system for uninterrupted shift from empty to full tank; alarm system optional; safety devices; vent relief; pressure and flow gages; automatic temperature control and panel.

CAPACITIES: 100 TO 2000 CFH.

Request "AD DISSOCIATOR DATA"

For "fine finish" hardening — annealing, soldering, sintering and carbo-nitriding

This newest Type IG Combusted Gas Generator is expressly designed to supply furnace atmosphere for decarb-free treatment of the most difficult high speed steels such as moly and 18-4-1 . . . and also gives highest quality results on tools and dies of high carbon high chrome steels. Employs compressed air and natural, city or propane gas. Supplies atmosphere for one or more furnaces, or carrier gas for carbo-nitriding mild steel and power metal parts. High CO-low CO_2 atmosphere assures maintenance of carbon and clean surface. Easily varied, accurately controlled "Carbon Pressure". Incorporates numerous improved design features.

CAPACITIES: 350 TO 2000 CFH.

Request "IG GENERATOR DATA"

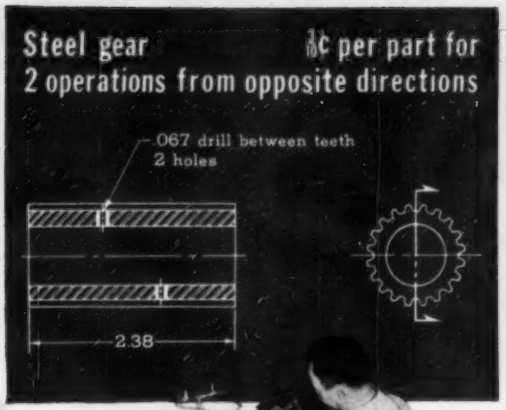
C. I. HAYES INC. 64 BAKER ST., PROVIDENCE, R. I.

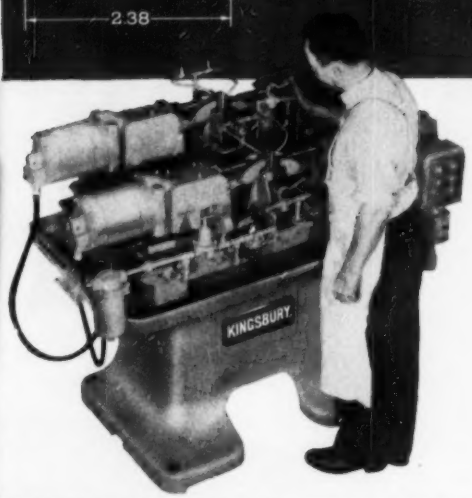
JOHN E. FISHER CO.
1125 LoChoi Area, Expwy No.
Pittsburgh 38, Pa.

L. J. EDWARDS
73 Eddy St., Prov., R. I.
New England Rep.

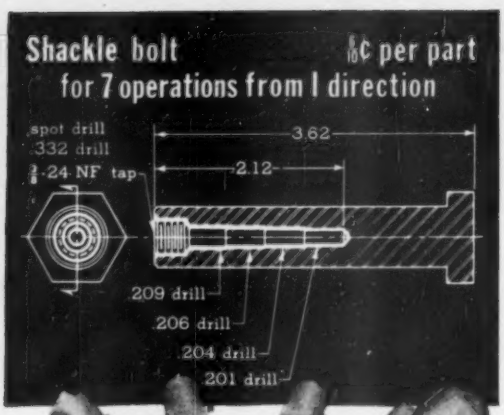
L. WAGNER
112 Lawrence Avenue

W. G. PRATT
[illegible]





900 PARTS AN HOUR GROSS. This setup saves money on a simple job. While the man changes parts in one fixture, two units locate and clamp another part, drill the holes and unclamp. He trips levers to start the cycles. Bushings guide all drills.



1000 PARTS AN HOUR GROSS. A 20-inch power index table has eight double fixtures and seven 2-spindle units that work on two parts at the same time. Angular mounting lets coolant flow inside the hole. Clamping and unclamping are automatic.

These 4 high production

Automatic, single-purpose machines save direct labor, handling, space and rejects on simple and complex work

Dear Sir:

Both jobs above are fairly simple. Those at the right are more complex. Some operations are easy, such as drilling the gear. Other operations are tough, such as milling through an arc on the transmission part.

In every case these machines save money because —

— each machine does the work of several general-purpose machines,

— there is almost no scrap.

One machine replaces several

Automatic drilling, milling and tapping units perform the operations shown in one chucking of the work. At the same time, the man changes the work in another fixture. Each machine here does from 1,440 to 9,520 operations per man-hour (80% efficiency). That means savings in direct labor, handling and space.

Empty scrap boxes

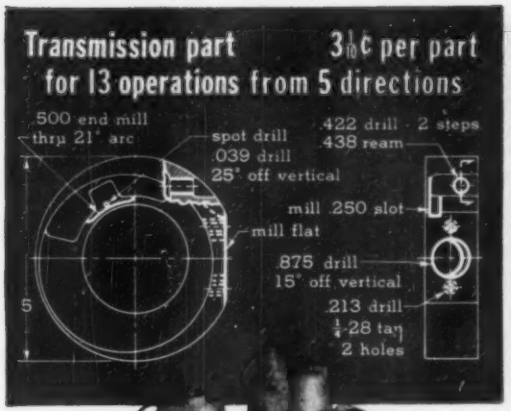
The inspectors won't toss many parts into the scrap boxes.

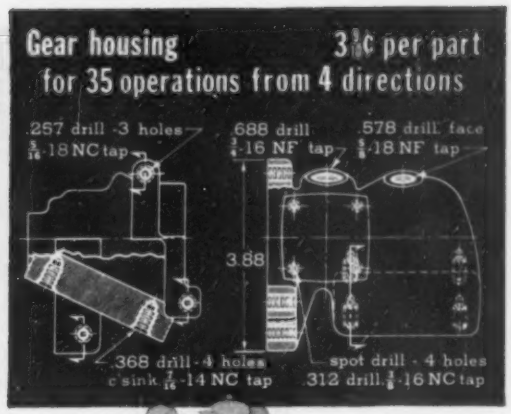
Tools work to close tolerances. We locate spindles to exact indicator readings and use precision bearings. Bushings guide drills and reamers.

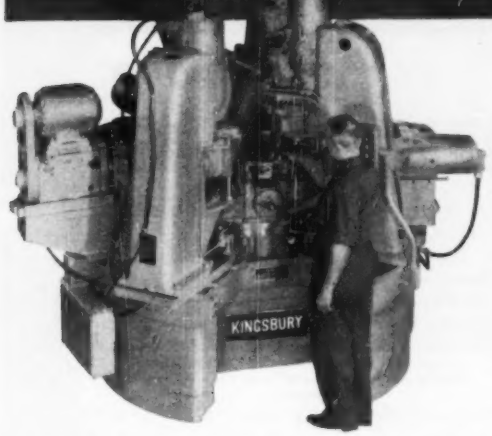
Product is uniform. Automatic work cycles never vary. Each part stays in its fixture undisturbed until after all operations.

Feeds and speeds are correct. We use single-spindle units to obtain the most efficient feed and speed for each operation. For operations of similar size and depth, units may have multi-spindle auxiliary heads.

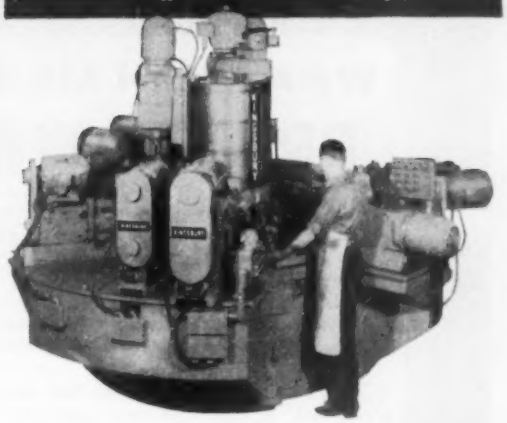
Machines will do accurate work for years at intensive production. Wear parts are of heat treated alloy steel. Gears are induction-hardened and shaved. Castings and weldments are normalized before machining. Index tables and fixtures are jig bored to minimum toolroom tolerances.







250 PARTS AN HOUR GROSS. This 26-inch indexing machine has ten units — one 15° above the horizontal, four horizontal, one horizontal off the radial line, two vertical and two 25° off the vertical. One milling unit oscillates through an arc of 21°.



340 PARTS AN HOUR GROSS. A 60-inch power index table has 12 fixtures that rotate 90° during indexing. Two vertical units on the central column do three holes on one face. Nine horizontal units work on three faces. Bushings guide 14 tools.

machines cut unit costs

Was our face red

We might as well admit it here, since *This Week Magazine* has already printed it: For twenty years we paid taxes on a house we never built. Some of our customers kidded us, "Never make mistakes, huh?"

How can you be sure?

How can you be sure we won't make mistakes on *your* machine? Well, it's possible. But as soon as it is set up, we test it with your sample parts. You get the samples to approve. If the parts do not meet your specifications, we work on the machine until you are satisfied. It won't take us long.

How can you be sure a Kingsbury will save you money? First ask our Mr. L. A. Carll for a proposal. Send him a print and tell him the operations and hourly output you need. Then compare that cost with your cost now. Find out for yourself using your own figures.

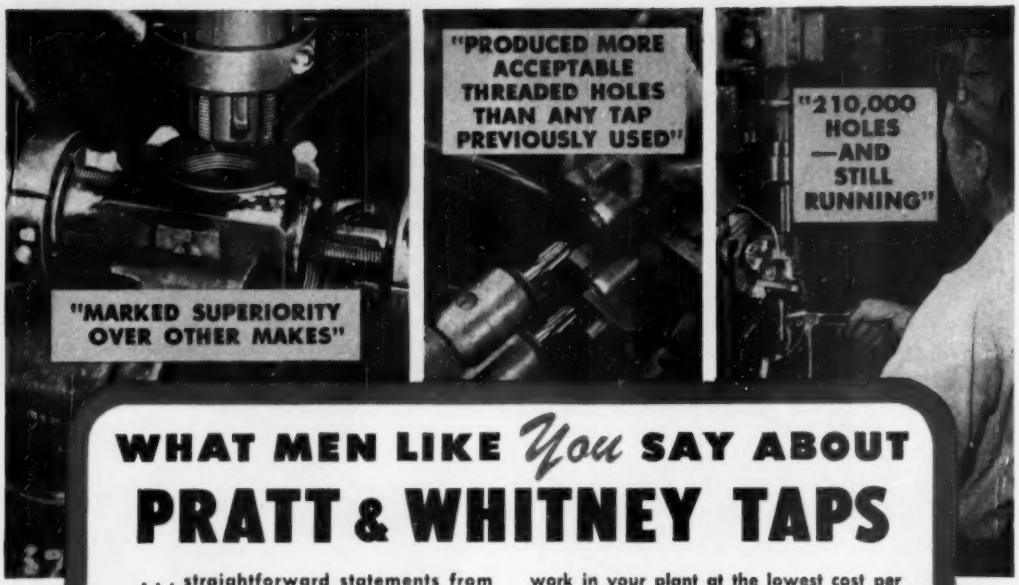
Sincerely,
Kingsbury Machine Tool Corp.
120 Laurel Street, Keene, N. H.

About the costs on the drawings

Each unit cost includes the man and machine on all operations shown – no power or overhead. We assumed three things: 1) 80% efficiency, 2) Each man's wage rate would equal the national average for such work, 3) The entire cost of each machine and tooling would be paid for after only 6000 hours of operation, a fraction of its useful life.

KINGSBURY

AUTOMATIC DRILLING & TAPPING MACHINES
for Low-Cost High Production


"MARKED SUPERIORITY OVER OTHER MAKES"
"PRODUCED MORE ACCEPTABLE THREADED HOLES THAN ANY TAP PREVIOUSLY USED"
"210,000 HOLES —AND STILL RUNNING"

WHAT MEN LIKE *You* SAY ABOUT PRATT & WHITNEY TAPS

. . . straightforward statements from prudent men like you who laud their lasting performance, their unmatched accuracy, their long wear life.

. . . evidence that expert designing, precision metallurgical control and skilled craftsmanship prevail at Accuracy Headquarters.

. . . proof that Pratt & Whitney Taps go to work in your plant at the lowest cost per hole tapped.

The right Taps for the job . . . for any material, tough or soft . . . in any type, standard or special, are in stock at your nearest P&W Branch Office:

Birmingham* • Boston • Chicago • Cincinnati • Cleveland
Detroit • Los Angeles • New York • Philadelphia
Pittsburgh • Rochester • St. Louis • San Francisco
*office only

PRATT & WHITNEY

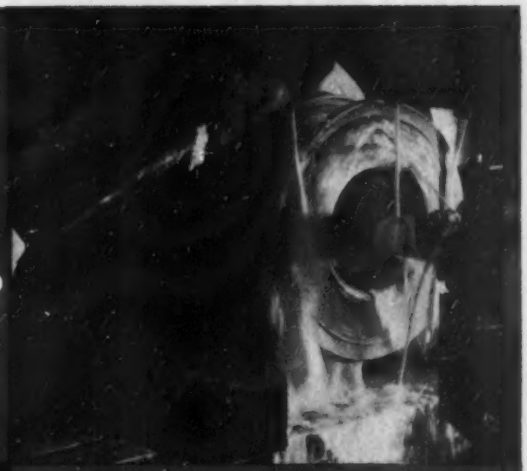
Division Niles-Bement-Pond Company
WEST HARTFORD 1, CONNECTICUT

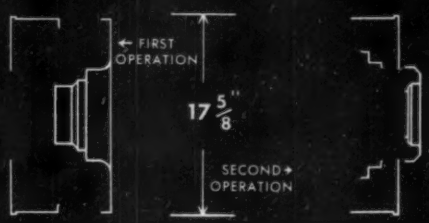
MACHINE TOOLS • CUTTING TOOLS • GAGES

90th Year

SYMBOL OF ACCURACY SINCE 1860

THOSE EXTRA MINUTES ON JOBS LIKE THIS CAN COST YOU PLENTY!



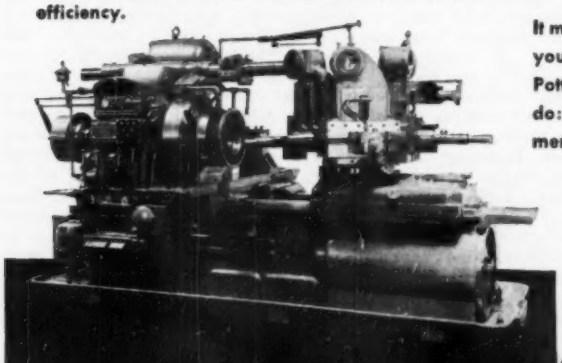


P&J Tooling, set up on the P&J 6DREL Automatics, is engineered to raise the most of the Machine's productivity in cutting times. All rough and finish cuts (indicated by heavy lines) on these semi-steel Cable Drum Housings.

HOW long would it take your present equipment to machine one of these semi-steel cable housings? We wouldn't know. But we *do* know that two P&J 6DREL Automatics machine both the first and second operations — completing 3.2 housings per hour (including chucking time) based on 85% efficiency.

Anything less than that is wasteful . . . proves obsolescence . . . proves you're missing profits you should be earning by replacing outdated machinery with modern, high speed P&J Automatics. Furthermore, effective division of labor costs is an important factor — as is conservation of productive floor space.

It may pay you well to compare the earning power of your present machines with the earning power of Potter & Johnston Automatics. It's an easy thing to do: just send parts or prints for a P&J Tooling recommendation and detailed time estimates.



P&J 50 YEARS' EXPERIENCE IN TOOLING FOR *Precision + Productivity + Economy*

POTTER & JOHNSTON CO.
PAWTUCKET, R. I.
subsidiary of PRATT & WHITNEY
Division Niles-Bement-Pond Company

SAME DRIVE . . . SAME PUNISHMENT

TRIPLE LIFE

ATLAS "BUILT-IN" STAMINA MINIMIZES WEAR AND REPAIR

Trouble-free three times longer . . . one chain outlasting three others! That's the authentic performance of Atlas Roller Chain employed on a chain-eating drive up in New England.

Atlas "Super-Life" Chain, with its "built-in stamina," is rolling up thousands of hours of outstanding performance not only on the New England installation but on drives in every section of the country . . . on conveyors, road machinery, cultivators, diesel engines, packaging machinery, lumber carriers, dryers, cards, trucks, roll forming machinery, calenders, and other types of machinery.

The die-hard stamina of Atlas Roller Chain and its ability to stay on the job is made possible by a special method of heat treating every component part. Bushings and pins are case hardened by the Atlas Nicarb Process which provides an outer surface strongly bound to the core of the steel. Link plates and rollers are also made of tough, heat-treated alloy steel; their uniformity achieved by automatic electronic instruments controlling the furnaces.

To keep present machines running smoothly with fewer unscheduled shutdowns for repairs and replacements, install "Atlas." Specify it for new equipment. There's a stock near you in nearly all types and sizes, ready for immediate delivery. Phone your nearest Atlas distributor or write:

Atlas Chain & Manufacturing Co., Philadelphia 24, Pa.

"SUPER-LIFE"

ATLAS CHAIN

Accessory Set No. 47, with 22 pieces, shown above. These pieces include — 12 jaws, 3 adjustable holders, center point, tram points, scriber, 2 triangular straight edges and foot block. Other sets and accessories available.

All Brown & Sharpe Jo-Block Accessories are designed skillfully and made with great care. In every way, they reflect the high precision standards of both Brown & Sharpe and Johansson.

With Jo-Blocks and a few related accessories, you can make a wide variety of precision measuring instruments for checking your quality control gages . . . easily and quickly. For example, a set of 81 Jo-Blocks makes 120,000 of the most accurate measuring tools in the world. Think of it! Accessories extend their uses even further — where else can you find such an extensive array of equipment for assuring the efficiency of your quality control program!

The exceptionally accurate gage shown in the illustration above was assembled in a moment with an adjustable holder, standard Jo-Blocks, and two jaws. There are countless time-saving, money-saving combinations of Jo-Blocks and accessories like this for control of accuracy in tool room work and for the adjustment of production gaging equipment.

No other name means so much in gage blocks as Johansson . . . famous the world over. Write for Illustrated Catalog. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

Johansson
BROWN & SHARPE

We urge buying through the Distributor

BROWN & SHARPE

When Does a Band Saw Become a Machine Tool?

M.T.

There are basic requirements of accuracy and proficiency that separate a "machine tool" from other power tools . . . characteristics such as those which distinguish a tool maker's screw-cutting, precision lathe from the woodworking lathes used in grade school manual training classes. Among metal-cutting band saws, only the MARVEL No. 8 Series Band Saws can qualify as *machine tools*, for only MARVEL Band Saws have the following capabilities and features:

1 Angular cutting from 0° to 45° right or left *without* moving the work. Built-in protractor.

2 Vertical blade power-fed into material—permits re-entrant cuts, notching, mitering, keyway sawing, etc.

3 Automatic power or manual feeds at the flick of a finger.

4 Feed pressure adjustable even when machine is running. Indicated in actual pounds of pressure.

5 Work clamped to table of machine. Working area more than 835 square inches.

6 Tee-slotted table facilitating clamping down of odd and irregular shaped pieces; easily supports heavy work or large and long structural shapes. Standard vise chucks work on either side of blade.

7 Automatic blade tensioning device. Every blade at uniform tension regardless of operating efficiency.

8 Adjustable upper guide roller holder insuring minimum section of unsupported blade on all sizes of material. Quick acting.

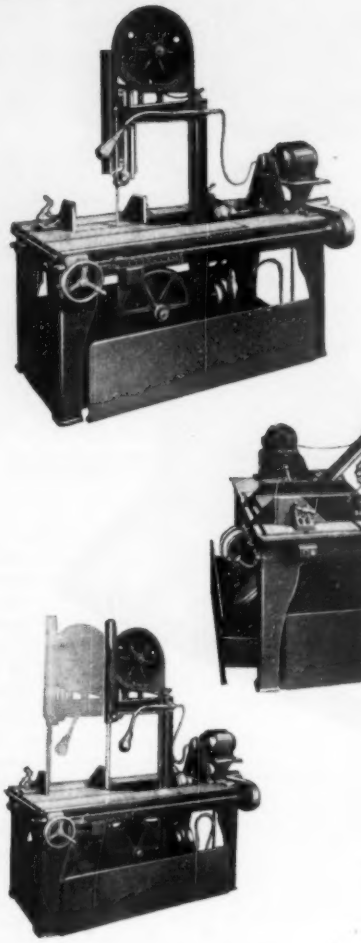
9 Built-in coolant system with delivery at blade entry point. Pump driven without belt or gears.

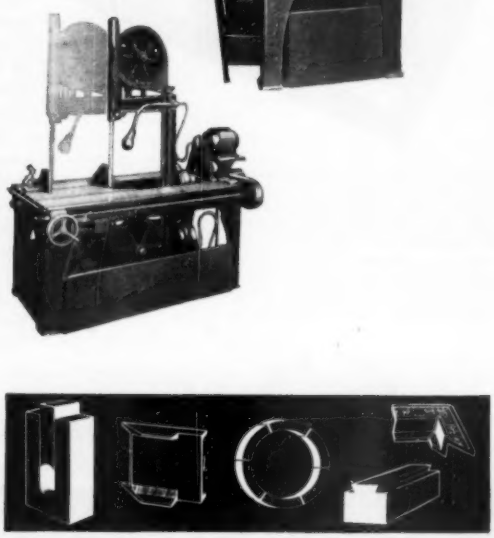
10 Replaceable vise ratchet and table wear strips of tool steel. New saw performance at all times.

11 LARGE CAPACITY: Standard: 19½" x 18¾". High column: 25½" x 18¾". Handles 99% of all work.

Before buying any metal-cutting band saw, be sure to see the versatile MARVEL No. 8. Your local MARVEL Field Engineer will demonstrate its significant "machine tool" characteristics and their application to your work, with costs, savings, cutting speeds and methods. This technical service is provided, without obligation, in the interests of better metal sawing.

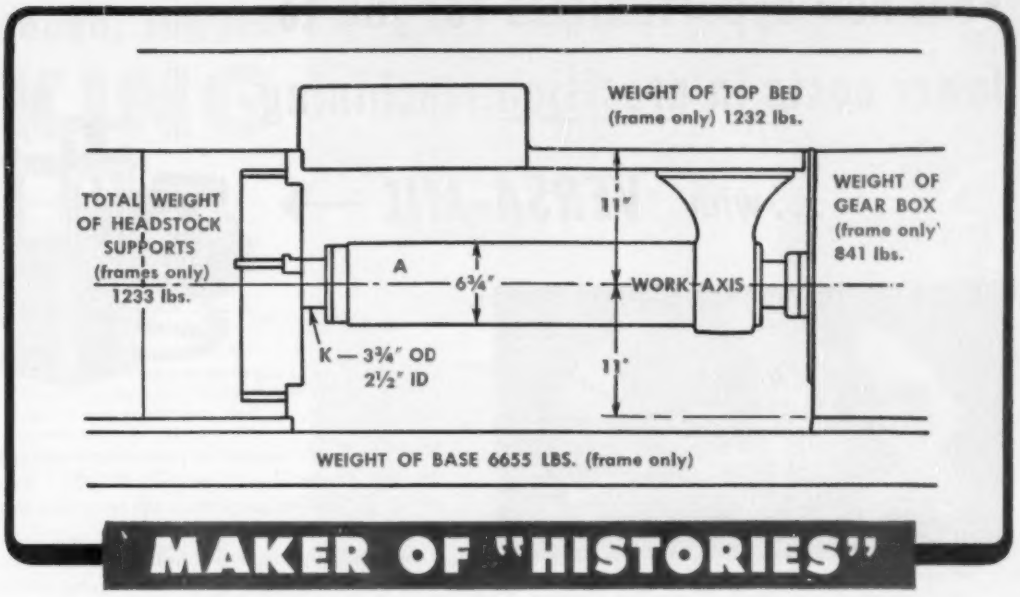
If you prefer to "study it out for yourself," write for the MARVEL C-49 Catalog.





ARMSTRONG-BLUM MFG. CO.
5700 Bloomingdale Ave. Chicago, USA

MARVEL Metal Cutting SAWS
Better Machines—Better Blades



MAKER OF "HISTORIES"

The above drawing illustrates a Tooling Area that has staged many outstanding cases of machine adaptation and performance. Case histories are very useful as examples of machine adaptation, but their blanket use as unqualified proof of dependable performance is not convincing.

Buyers know that varying requirements and conditions of various plants make "buying what the other fellow buys" an unsafe practice. They know that good case histories will result if machine facilities have been properly selected. No plant could long afford to have it otherwise.

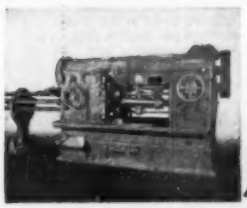
A "top performer" of the 1½" SIX SPINDLE CONOMATIC TOOLING AREA, shown above, is the MAIN END SLIDE. The specific data given tells why:

1. **It has a greater maximum load recommendation and a stronger frame support than the main end slide of any other "automatic".**

   The 272 lb. alloy carburized steel Main End Slide, A, is 33⅝" long, and has a maximum load recommendation of 4800 ft. lbs. Its round surface is machined to close limits. It is supported in nickel iron, split, sleeves on the alloy steel Way, K, with a total bearing of 136.9 sq. ins.

2. **It handles more work; has more adaptable tooling positions, and more selective feeds, than the main end slide of any other "automatic".**

   The 27⅞" tooling-length of the Slide handles shaft jobs up to 18" in length. The 2⅝" swing clearance permits die-head threading to full machine capacity in any, or all, six positions without Slide alteration. Nine pairs of pick-off gears give 68 feed changes for each work spindle speed.



Buyer's Comparison Chart will guide you to full information

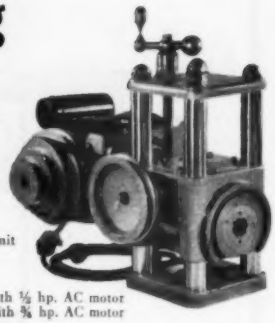
A Comparison of ALL Automatics is in Favor of Cone

Conomatic

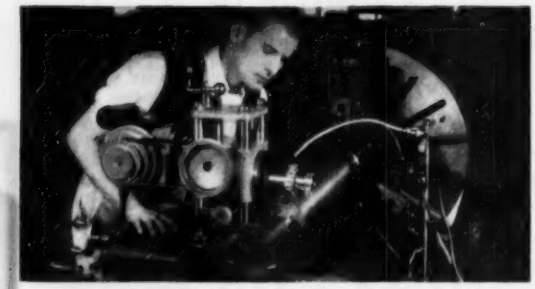
CONE AUTOMATIC
MACHINE COMPANY, INC.
WINDSOR, VT., U.S.A.

Four new opportunities for you to lower costs in precision machining

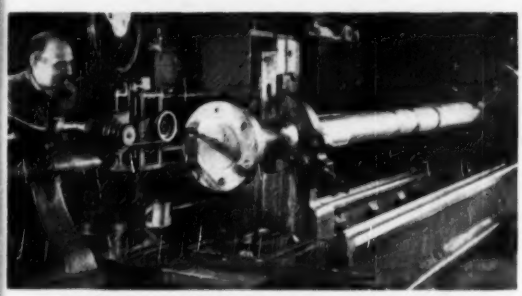
...with VERSA-MIL →



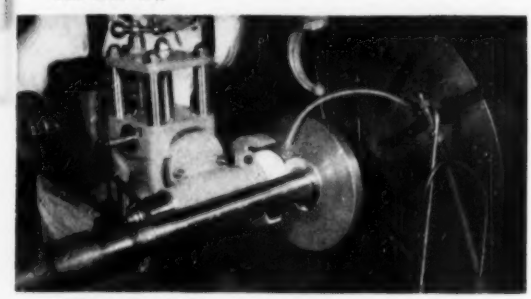
Versa-Mil Power Unit
6" travel on posts
#3 Morse taper
6" x 6¼" base
Weight: 89 lbs. with ½ hp. AC motor
104 lbs. with ¾ hp. AC motor



MILLING KEYWAY: Milling ¾" x ⅜" keyway in cold rolled shafting at rate of 1" per min. 3" cutter at 98 rpm. 30" swing lathe, ½ hp. motor



OFF CENTER BORING AND DRILLING: Complete machining of coupling flange of propeller tail shaft without removing work from the lathe. Time saved—65%



GRINDING BEARING SEAT AND SHOULDER: Cylindrical and rotary surface grinding in one set-up with 4" x 1¼" cup wheel.

With a Versa-Mil mounted on your machine tool, you can now handle *almost any precision job* . . . with savings in handling, preparation and set-up time that provide significant shop economies.

Versa-Mil helps cut costs in milling keyways, faces, splines, gears, threads . . . in drilling, reaming, boring and routing . . . in all kinds of external and internal grinding on cylindrical, taper and flat surfaces. It points the way to new profits in—

(1) **PRODUCTION:** Combining with lathes, planers, boring mills, horizontal millers and vertical turret lathes or fixtures to make special-purpose tools.

(2) **HEAVY MACHINING:** Reducing handling, preparation and set-up time.

(3) **PLANT MAINTENANCE:** Serving as a portable machine tool taken to the work instead of bringing the work to the shop. Saves disassembly, transportation and down-time.

(4) **SMALL SHOPS:** Taking the place of costly machine tools.

We'd like to tell you more of the substantial contribution Versa-Mil can make to lowering your machining costs. Please write for further information. It will merit your careful consideration.

VERSA-MIL COMPANY
30 Church Street, New York 7, N. Y.

USERS OF VERSA-MIL read like the "blue book" of industry. Note the number of units now serving these companies:

American Can Co. . . . 3	Phelps Dodge Copper Products Corp. . . . 2
General Electric Co. . . . 14	Fairchild Engine & Airplane Corp. . . . 2
International Harvester Co. . . . 3	Standard Oil Co. of New Jersey . . . 15
New York Central Railroad . . . 6	Westinghouse Electric Corp. . . . 4
Otis Elevator Co. . . . 2	Wright Aeronautical Corp. . . . 4

VERSA-MIL

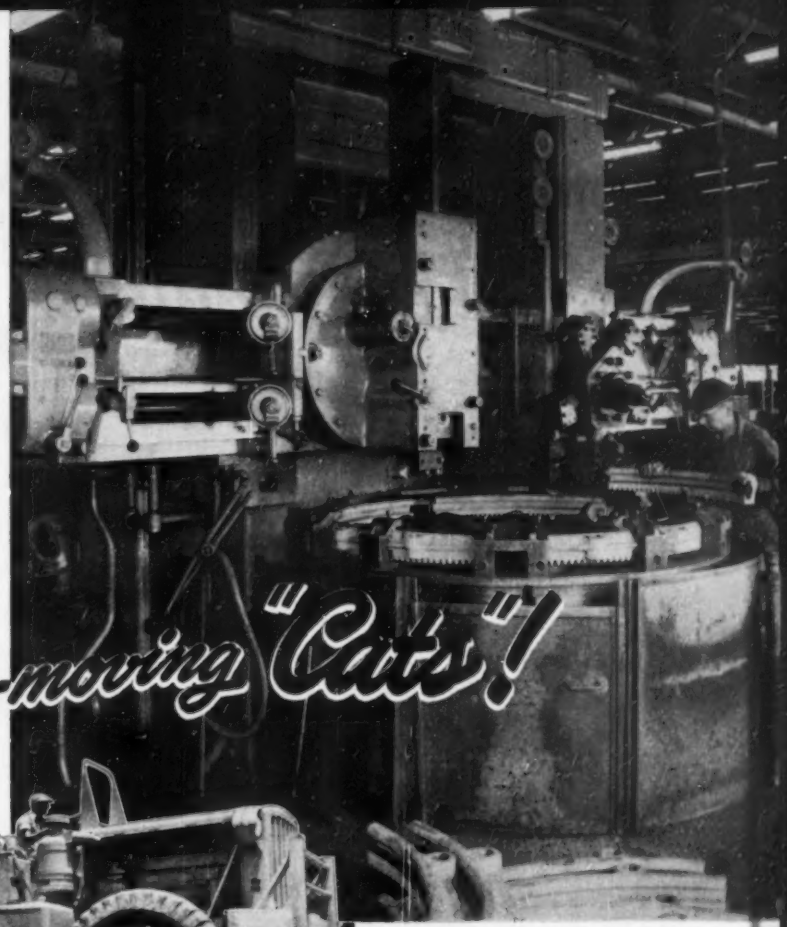
The Tool for Precision Milling, Drilling and Grinding

It takes a tough, rugged KING

(*Right*) 72" KING Vertical Boring & Turning Machine at Caterpillar Tractor Co., Peoria, Illinois. Piece being machined is a side shift rack for "Caterpillar" No. 12 Motor Grader.

(Below) "Caterpillar" DW 20 4-wheel Diesel Tractor with W20 Wagon. This new high-speed, long-haul, high-capacity, earth-moving combination is the result of five years of intensive research and development. Sturdy parts for both units are precision machined in record time on "Caterpillar's" big, husky KING.

to build *mountain-moving "Cats"!*



Men who design and manufacture tough, big-muscled "Caterpillar" products require the same qualities of rugged power and stamina in the machine tools that build them. This 72" New-Series KING has the power, rigidity and range of speeds that make it ideally suited to "Caterpillar's" production requirements.

Here, as in other leading industries, New-Series KING Vertical Boring & Turning Machines are consistently proving their ability to cut costs and improve quality on the complete range of boring, facing, and turning work. Investigate KING's cost-cutting advantages. Ten sizes–30" to 144"—the *widest* size range in the field.

WRITE FOR NEW CATALOGS

New illustrated KING catalogs give detailed description of machines and complete specifications. Catalog K-1 features machines sizes 30", 36" and 42"; K-2, sizes 52", 62" and 72"; K-3, sizes 84" and 100"; K-4, sizes 120" and 144".

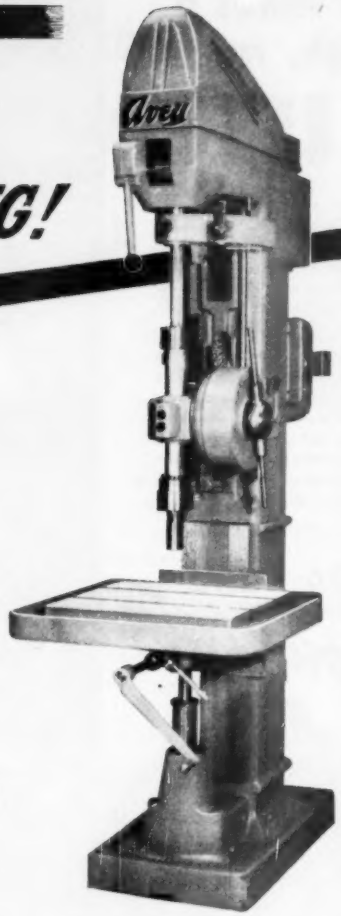
American Steel Foundries

KING MACHINE TOOL DIVISION

CINCINNATI 29, OHIO

Builders of King Vertical Boring & Turning Machines and Sebastian Lathes

Tops in...
PRODUCTION*EERING!*



#3 AVEY BMA-6

A sensitive and upright machine combined! Wider speed and feed ranges for holes up to 1½" in cast iron. Complete with Standard Frame Reversing Motor & Control for Tapping. Hand or Automatic Feed. Write for Bulletin 847.

All over the world, Avey Sensitive and Upright Drilling and Tapping Machines are setting new records for cost cutting and production boosting. Avey's records speak for themselves . . . and men-in-the-know are listening!

Whatever your production problem, Avey's Sensitive and Upright Drilling and Tapping Machines—whether Standard Models or of Special Design—will solve that problem for you . . . *efficiently and economically!* You can't buy better machines . . . for less!

YOUR DRILLING AND TAPPING PROBLEMS GET IMMEDIATE ATTENTION FROM AVEY'S EXPERIENCED SALES ENGINEERING STAFF!

Avey DRILLING MACHINES

Write for free Engineering Bulletin 749

"THE BEST AGENTS EVERYWHERE SELL AVEY"

Avey DRILLING MACHINE COMPANY • CINCINNATI 1, OHIO

Deep Hole Drilling Machines — Drilling and Tapping Units
Automatic Index Tables — Special Drilling and Tapping Machines

They cost you less to use

THERE'S A UNION REAMER FOR PRACTICALLY EVERY INDUSTRIAL APPLICATION

Hand Reamers
Fluted Shell Reamers
Expansion Reamers
Morse Taper Reamers
Jobbers' Reamers
Fluted Chucking Reamers
Taper Pin Reamers
Helical Flute Taper Pin Reamers
Rose Chucking Reamers
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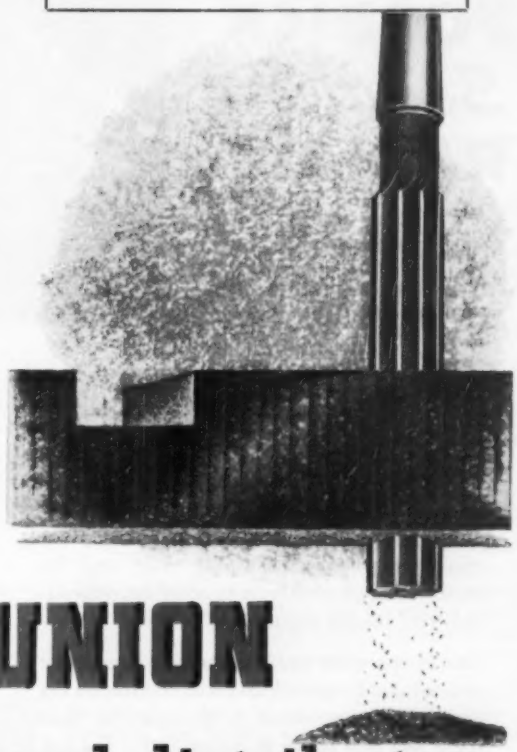
Bridge & Boiler Reamers
Reamer Sets

UNION *reamers, standard or special, last longer on every type of job*

Whether you're removing a lot of metal or a few thousandths, on run-of-the-mill or high precision work, Union Reamers are your best bet for the long life and accurate performance that save time and cut production costs.

Chances are your reaming jobs can all be handled by proper selections from the broad range of Union Reamers made to top-quality standards.

See your Union Distributor for all standard or special needs. If your applications are unusual, he'll arrange to get all necessary information, including sketches. Look for his name in THOMAS' REGISTER on Union's insert in the "Drills, Twist" section.



no other reamer will outperform a **UNION**

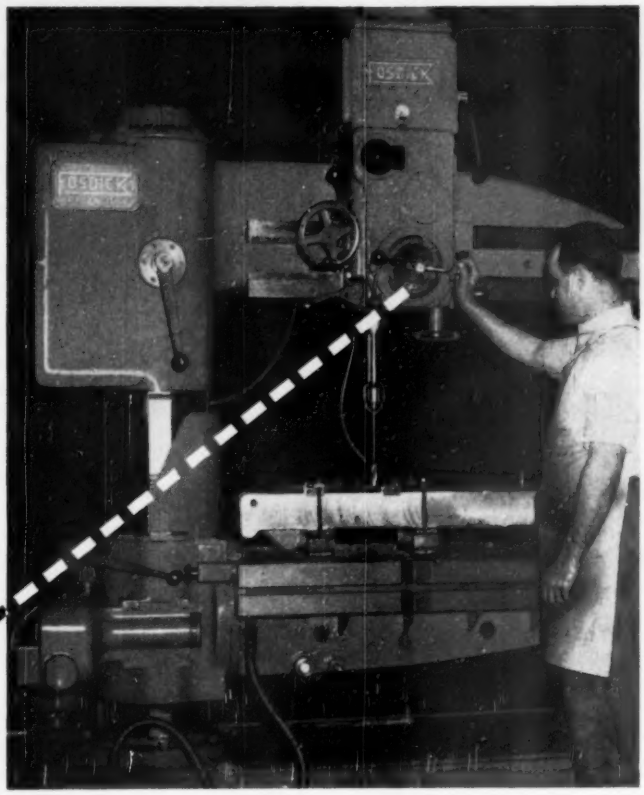
contact your local distributor

His name is listed in Union's THOMAS' REGISTER insert under "Drills, Twist."

UNION TWIST DRILL COMPANY, ATHOL, MASSACHUSETTS

Milling Cutters · Gear Cutters · Twist Drills · Hobs · Reamers · Carbide Tools

We own and operate S. W. CARD MANUFACTURING CO. Division, Mansfield, Mass. Taps, Dies, Screw Plates . . . BUTTERFIELD DIVISION, Derby Line, Vt., Taps, Dies, Screw Plates, Reamers . . . BUTTERFIELD DIVISION, Rock Island, Que., Milling Cutters, Twist Drills, Hobs, Reamers, Taps, Dies, Screw Plates.



The FOSDICK *Sensitive* RADIAL

maximum production
less operator fatigue

If you need holes up to 1½" diameter it will be to your advantage to investigate this exceptionally versatile machine.

The sturdy construction of the Fosdick Sensitive Radial from base to arm—the rigid one piece column—the heavy adjustable table—and the massive arm all contribute to accurate, dependable and speedy production.

Ease of operation and less operator fatigue are assured due to centralization of controls on the head within easy reach of the operator. Both table and arm swing in arc of 360°. The adjustability of the table enables operator to locate the table in correct position for every job. It also enables him to swing the table out of the way in the event an emergency tall job comes up that may be mounted on the conventional base.

The Fosdick Sensitive Radial offers all the advantages of high speed sensitive drilling plus the versatility of radial design and construction.

The illustration shows an installation in a machine shop in St. Louis, Missouri. Whether yours is a production plant—and machine shop—or a tool room, you'll find this machine is a most profitable investment.

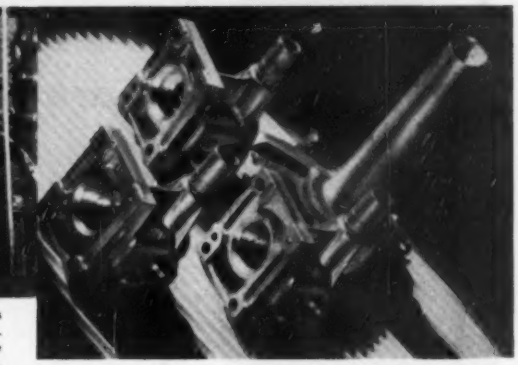
• For complete details write for the Fosdick Sensitive Radial Bulletin S.R.A.

FOSDICK MACHINE TOOL *Company*
CINCINNATI 23, OHIO

If you're considering new die casting machinery . . .

why not profit from the experience of others?

One of a battery of 5 Model 400 Clevelands in operation in the modern plant of the St. Louis Die Casting Corp., St. Louis, Mo. The operator is removing the casting shown at right.



ST. LOUIS DIE CASTING CORP. *gets better castings, faster, at less cost* WITH CLEVELAND MODEL 400's

These three examples are typical of the production —*around the clock*—that experienced die casters are getting from Cleveland Die Casting Machines. You too can get better castings, faster, at less cost, with Clevelands.

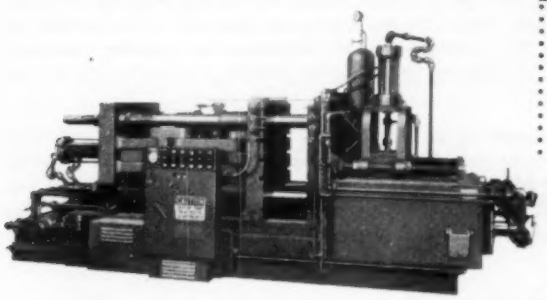
Let a Cleveland engineer show you *further proof* of the advantages these machines can bring to your die casting production. For complete information on machine specifications, write now for bulletins.

340 SHOTS PER HOUR!
Weight of metal per shot 14.35 oz. Weight per piece 4.6 oz.

Zinc fan gear case casting from two-cavity die with movable cores. Most of the cored holes required no further finishing. Three critical dimensions are held to ± .001" tolerance. Each casting receives a careful spot check, and at time photo was taken, 170,000 castings had been produced without a single reject.

325 SHOTS PER HOUR!
Weight of metal per shot 3.3 lbs. Weight per piece 4.75 oz. Zinc nuts cast from 8-cavity die.

375 SHOTS PER HOUR!
Weight of metal per shot 1.15 lbs. Weight per piece 1.8 oz. Zinc nobs for electric control panel cast from 6-cavity die.



Cleveland Model 400 Universal High-Pressure Hydraulic Die Casting Machine for zinc, tin or lead. Hot metal end can be easily changed to convert to cold chamber machine. 36" x 38" die plates. Approx. 800,000 lbs. locking pressure.

THE CLEVELAND AUTOMATIC MACHINE COMPANY

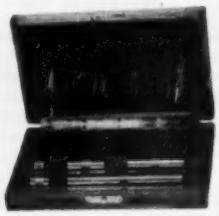
4928 Beech Street
Cincinnati 12, Ohio

SALES OFFICES: CHICAGO
CLEVELAND • DETROIT
HARTFORD • NEWARK

Manufacturers of a Complete Line of Single Spindle Automatic Screw Machines and High Pressure Hydraulic Die Casting Machines

Shop Set MTT . . . 35 blocks giving 100,000 combinations in ten thousandths. Price in mahogany case, $100.00.

Economy Set MT . . . Over 5000 combinations in thousandths. Price in mahogany case, $40.00.

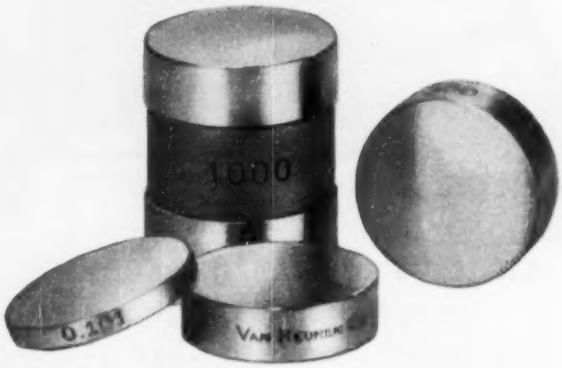


Micrometer Set M21 . . . Includes 1", 2", 3", 4", 5" and 6" Microgages. Price in mahogany case, $60.00.

Toolmakers Set M64 . . . Gives 121 combination in 10ths, 32nds and 64ths. Price in mahogany case, $17.50.

The New Van Keuren

7/8 DIAMETER MICROGAGES are the best buy . . . . . .



60% More Wearing Surface . . . 25% Greater Accuracy . . . No increase in price.

A FOUNDATION FOR ACCURACY FOR 25 YEARS

Van Keuren Microgages have been popular for over 25 years, because they provide a low cost means of securing accuracy in the shop, to meet the demands of the inspection department. The original Microgages were made 11/16" in diameter. The ⅞" body diameter of the NEW Microgages are ground true cylinders, and the end surfaces are held square with the body within close limits. This enables them to be easily aligned on machine ways for measuring carriage travel. The new Microgages have 40% more wearing surface than rectangular gages and they wring together tenaciously. The ⅞" diameter body provides excellent rigidity for the 6" long blocks.

Microgages up to 1" length are held within a tolerance of plus 12 millionths minus 8 millionths. They have an average wear allowance of 4 millionths oversize. They are available as individual gages from .0625" to 6" length, or in sets especially designed for general shop use, for tool setting and for tool makers and machinists.

THE Van Keuren CO., 173 WALTHAM STREET, WATERTOWN, MASS.

31st YEAR

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Plug Gages • Carboloy Measuring Wires

23 CUBIC INCHES TOUGH STEEL REMOVED IN 58 SECONDS

Using

BARBER-COLMAN

TANTUNG-TIPPED

SLAB MILLING CUTTERS

Husky cuts in tough steel call for extra stamina in cutting tools — ability to do the job at a good rate of production, without sacrificing tool life.

For example, in this brake band milling operation, Barber-Colman Tantung-Tipped Cutters remove 23 cubic inches of SAE 5140 steel *in 58 seconds*, and do it producing 250 pieces per sharpening. This is a total of 2937 cubic inches of metal removal between sharpenings. High speed steel cutters do not stand up under this fast heavy cut.

If you have a metal removal problem, whether it's to get greater production or more economical tool life, ask your Barber-Colman representative for recommendations on *Job-Engineered Cutting Tools.*

JOB FACTS

Operation — Remove ⅜" stock, 1¾" wide on brake band 7" dia.

Cutters — B-C Tantung-Tipped Slab Mills, 4½" x 4" x 1½"

Material — SAE 5140 Steel

Cutter Speed — 175 RPM

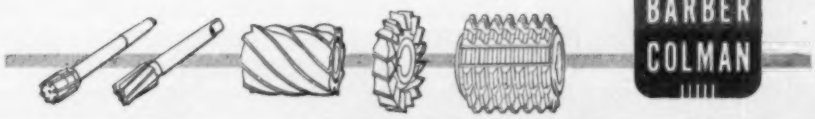
Tool Life — 250 pieces per sharp. 15-20 sharpenings

FREE

Get this complete catalog of Standard and Special Milling Cutters and Reamers. Write for File No. 8142.

Barber-Colman Company

GENERAL OFFICES AND PLANT, 8142 LOOMIS ST., ROCKFORD, ILLINOIS, U. S. A.

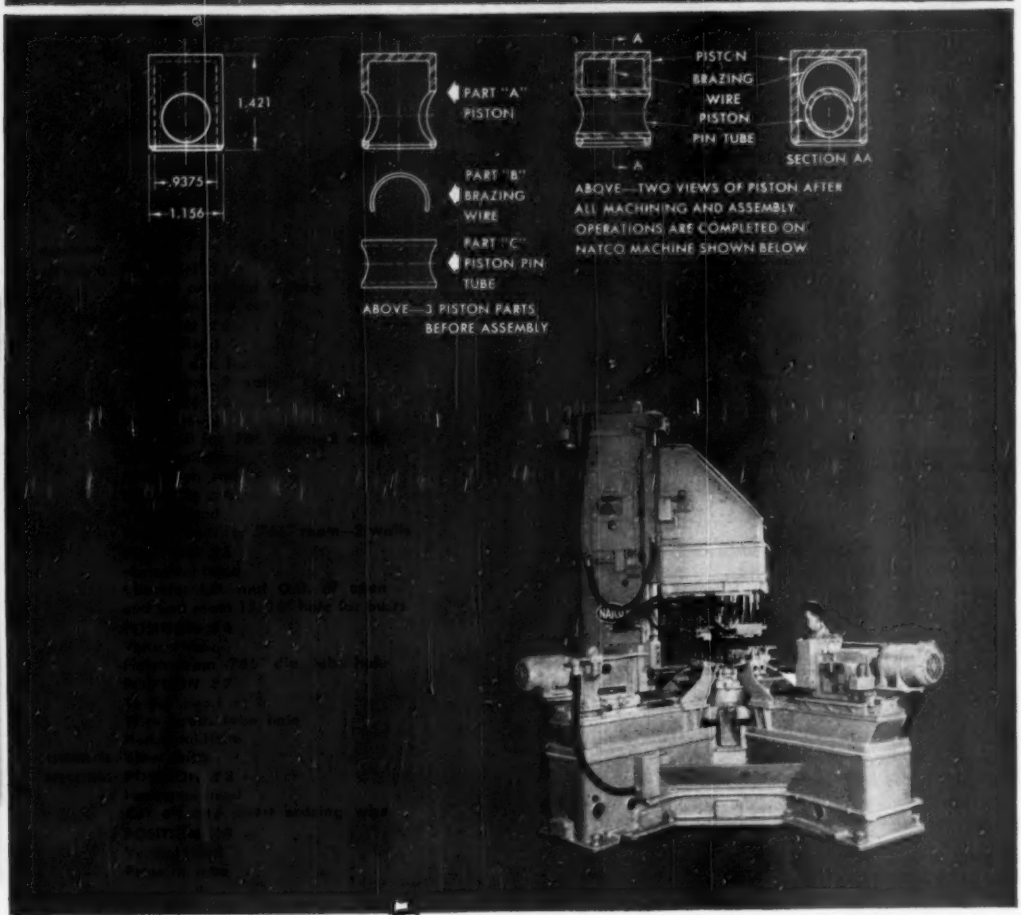


BARBER COLMAN

MACHINES AND ASSEMBLES

three parts automatically to complete

248 Refrigerator Pistons Per Hour



NATCO DRILLING, BORING, TAPPING AND FACING MACHINES

NATCO

Call a Natco Field Engineer

This NATCO four-way vertical and horizontal drilling machine is just one of the many examples of the way NATCO contributes to higher production and lowered costs for industry. Send us your drilling, boring, tapping or facing problems . . . our engineers have the solution.

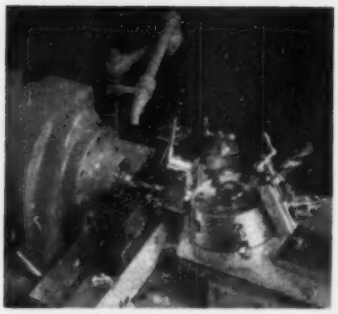
Write for NATCO "Success Story" No. 5
Dept. AM

NATIONAL AUTOMATIC TOOL COMPANY, INC., Richmond, Ind., U. S. A.
Branch Offices: 1809 Engineering Bldg., Chicago • 409 New Center Bldg., Detroit • 1807 Elmwood Ave., Buffalo • 2902 Commerce Bldg., New York City

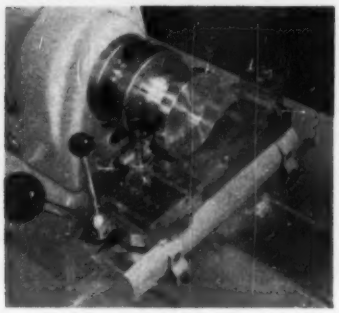
HARDINGE
ELMIRA, N.Y.

HIGH SPEED PRECISION SECOND OPERATION MACHINES

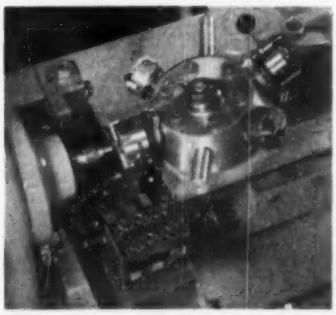
Produce More Parts at Lower Cost



Collet Chucking — The right machine for collet work of one inch or less in diameter.



Step Chuck Work — For rapid and accurate holding of tubing, casting, moldings, stampings, and machined parts. Capacity to 6".



Bar Work — Equipped with bar feed, machine is readily converted to high speed bar work.

Correct size of machine in relation to work saves loss from under-capacity production on larger turret lathes. High spindle speeds to 4000 r.p.m., permit full capacity cutting and excellent finish. Sustained accuracy and ease of operation assure precision results.

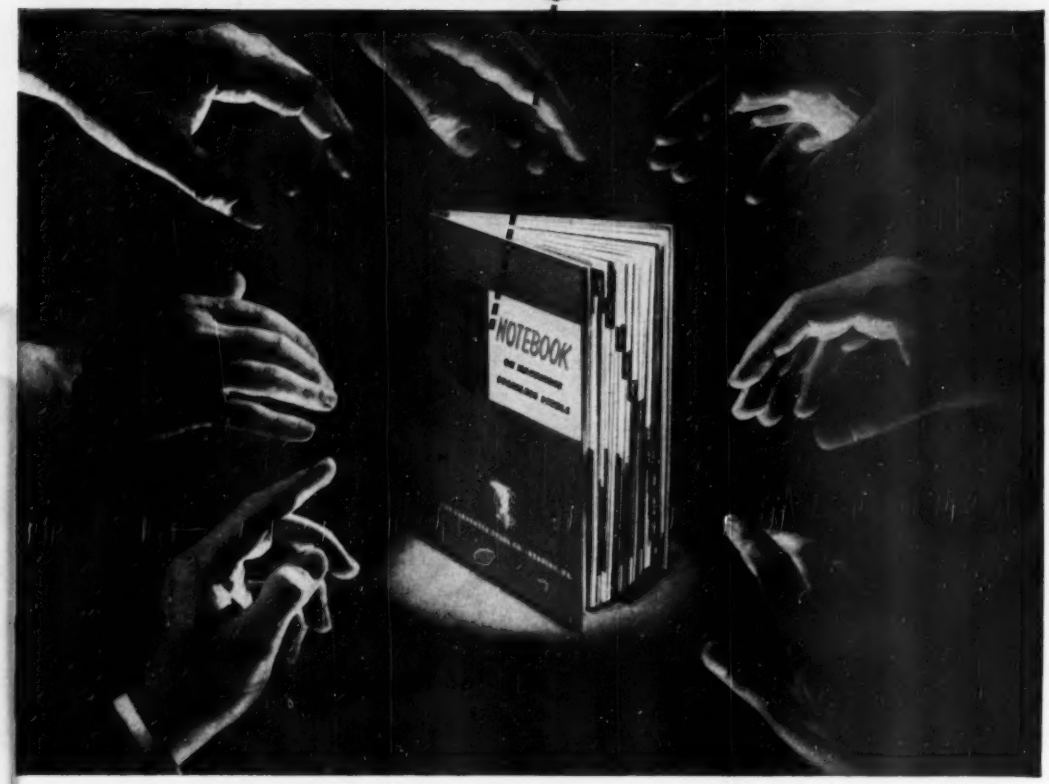
You need this machine for rapid, accurate production of parts. Save time and money through the use of Hardinge Precision Second Operation Machines in your plant.

Send for free illustrated Bulletin DSM 59

HARDINGE BROTHERS, INC., Elmira, N. Y.

Offices in principal cities. Export office 269 Lafayette St., New York 12, N. Y.

X MARKS THE SPOT



...Where *Carpenter* Customers Find New Ways to Get Stainless Jobs Done Faster

It's easy to see how *less tool grinding* means less machine down time. And it saves because you make fewer tools. *Reducing the number of rejects* on Stainless jobs—getting the best possible finishes—can make a big difference in your unit production rate, too.

Many a customer of ours has found this a good formula for easier machining of Stainless. First use the Stainless that is *uniform* every time you get it—*Carpenter* Free-Machining Stainless. Then take advantage of the shop help Carpenter can give you.

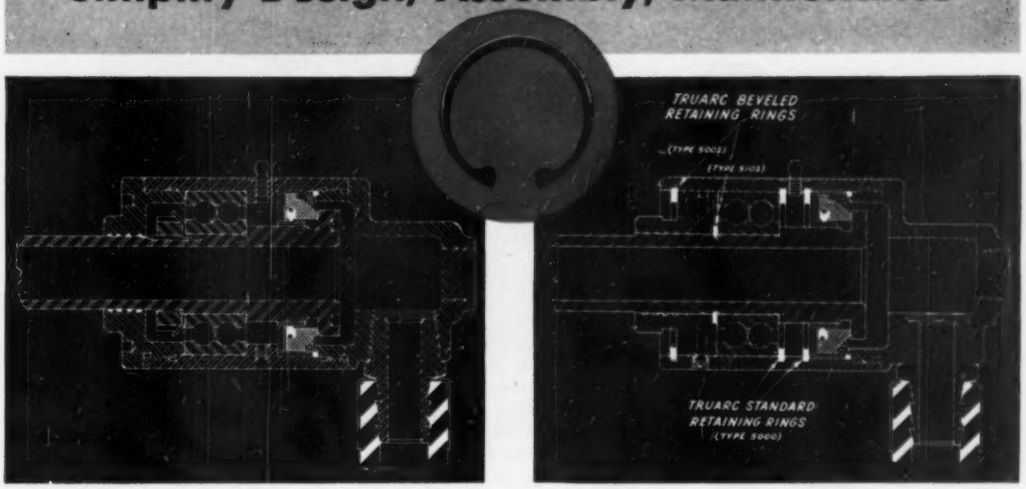
For example, the men who work out of your nearby Carpenter Mill-Branch Warehouse will be glad to help out on any problems that come up. Or, we can give you a personal copy of the Carpenter "NOTEBOOK on Machining Stainless Steels". It's packed full of useful shop hints on turning, drilling, threading, milling, lubrication, etc. If you would like a copy, just write us a note on your company letterhead, indicating your title.

The Carpenter Steel Company, 109 W. Bern St., Reading, Pa.
Export Department: Woolworth Bldg., New York 7, N.Y.—"CARSTEELCO"

Carpenter
STAINLESS STEEL
takes the problems out of production

For Easy-to-Use Stainless Call Carpenter. Warehouses in principal cities throughout the country.

4 Truarc Rings save $2.41 unit cost, Simplify Design, Assembly, Maintenance



Conventional Way. This design died on the drawing boards, because the Deublin Company, Northbrook, Ill., found the simplified design, using Truarc Rings, superior and more economical.

Truarc Way. Truarc Beveled Retaining Ring holds cap in place, takes up end play, locks entire assembly. Second Beveled Ring positions ball bearing on rotor. 2 standard Truarc Rings position bearing and removable seal, eliminate shoulders, permit manufacture of housing from strong, non-porous, easily machined brass tubing. Unit can be serviced in minutes simply by removing 2 Truarc Rings.

HOW $2.41 WAS SAVED

Materials saved	
decreased wall thickness of housing	$.79
eliminated bearing lock nut and washer	.18
	.97
Machine operations eliminated	
Bore, undercut, and tap cap end of housing	.39
Locate cap on arbor, and chase threads	.28
Drill spanner wrench holes	.10
Cut thread on rotor for lock nut	.09
Mill slot in thread for tang on lock washer	.18
Drill spanner wrench holes in rotor	.10
	1.14
Assembly operations eliminated	
Install lock washer, tighten lock nut, bend lug	.20
Assemble cap into housing	.10
	.30
TOTAL SAVINGS	$2.41

THE Deublin Union—a rotating joint for steam, air, or water—is simple, rugged, easy to service. 4 Waldes Truarc Rings hold entire unit together, permit simplified design, cut unit cost $2.41.

Improve and simplify your own product design with Truarc Rings, and you too will cut costs. Wherever you use machined shoulders, nuts, bolts, snap rings, cotter pins, there's a Waldes Truarc Ring that does a better job of holding parts together.

Truarc Rings are precision engineered. Quick and easy to assemble, disassemble. Always circular to give a never-failing grip. They can be used over and over again.

Find out what Truarc Rings can do for you. Send your blueprints to Waldes Truarc engineers for individual attention, without obligation.

RETAINING RINGS

WALDES KOHINOOR, INC., LONG ISLAND CITY 1, NEW YORK

WALDES TRUARC RETAINING RINGS ARE PROTECTED BY THE FOLLOWING PATENT NUMBERS: U. S. PATENTS 2,382,948; 2,420,821; 2,411,751; 2,487,803; 2,487,902; 2,491,306 AND OTHER PATENTS PENDING

AM102

Waldes Kohinoor, Inc., 47-16 Austel Place
Long Island City 1, N. Y.

Please send the new catalog on Waldes Truarc Retaining Rings.

Name_____

Title_____

Company_____

Business Address_____

City_____ Zone_____ State_____

4KW

ARMSTRONG

Modern Tooling Calls for *the Correct*

ARMSTRONG TOOL HOLDERS

for each operation

In the old days it was a matter of pride with toolmakers to be able to do the work at hand with the tools at hand. It's a credit to their skill that they could devise to cut threads, do cutting-off and facing, as well as many other operations with one ARMSTRONG TURNING TOOL, but, at today's labor cost, this would be an expensive practice. The maximum of productive work and true machining efficiency can only be obtained by providing the correct ARMSTRONG TOOL HOLDERS for each operation.

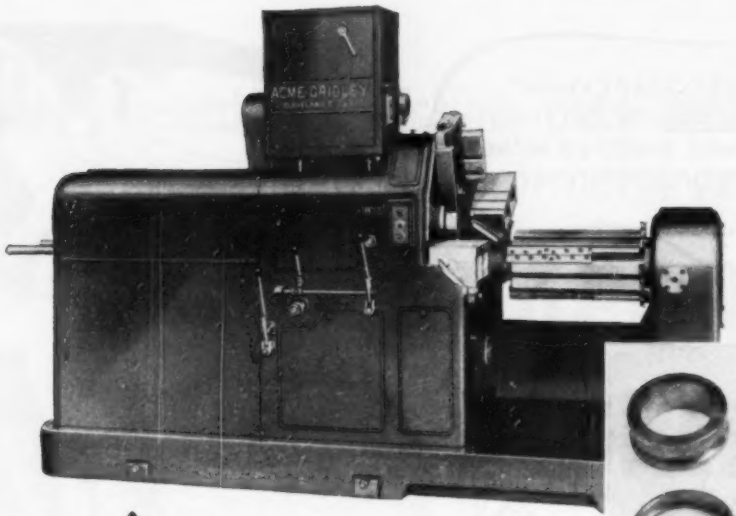
The Armstrong System of Tool Holders provides specially designed ARMSTRONG TOOL HOLDERS for every operation on lathes, planers, slotters, and shapers . . . Turning Tools, Boring Tools, Threading Tools, Knurling Tools, Cutting-Off Tools; tool holders with straight shanks, with off-set shanks, rigid tools and "spring" tools . . . special tool holders for high speed steel bits or blades, for ARMIDE (carbide-tipped) Cutters, for ARMALOY (cast alloy) Bits and Blades.

These modern efficient ARMSTRONG TOOL HOLDERS are as available as your telephone for they are carried in stock by your local ARMSTRONG Distributor.

ARMSTRONG BROS. TOOL CO.

"THE TOOL HOLDER PEOPLE"

5215 W. ARMSTRONG AVENUE **CHICAGO 30, ILL.**



Here's Your Answer to Obsolete Machining Methods

For this class of work....

For gear blanks, bearing races, collet parts and the like, the new National Acme Model M Single Spindle Automatic will out-produce older methods as much as ten to one.

Check these features and you'll see why the Model M gives you "*more good pieces in the pan*":

- **Eight Independently Operated Tool Slides—permit use of speeds and feeds best suited to each cut, using carbide or high speed cutting tools.**
- **Three Ranges of Automatic Spindle Speeds—provide correct surface speed for a wide range of diameters.**
- **Easily Accessible Camming—minimizes change time on small lot setups.**
- **Turret Indexes Independently—several short end operations can be performed while heavy forming cuts are being made from the side slides.**
- **Rugged, Open Frame—strength to take full advantage of carbide tools, yet plenty of room for chip clearance and easy tool adjustment.**

The Model M is a completely new, fully automatic machine, available in four capacities—from 2-5/8" to 5-1/2". For ease of operation, for speed, stamina and economy, this new National Acme is your best bet to beat obsolescence in your shop. May we show you production estimates on your jobs?

Ask for Bulletin M-50

Machine obsolescence is the creeping paralysis that strangles profit.

The NATIONAL ACME CO.

170 EAST 131st STREET • CLEVELAND 8, OHIO

Acme-Gridley Bar and Chucking Automatics: 1-4-6 and 8 Spindle • Hydraulic Thread Rolling Machines • Automatic Threading Dies and Taps • The Chronolog-Limit, Motor Starter and Control Station Switches • Solenoids Centrifuges • Contract Manufacturing

WISH OUR WEST COAST PLANT COULD STANDARDIZE ON CUTTING TOOLS. IT SURE HAS SAVED US MONEY AND SPEEDED PRODUCTION HERE.
* Standard Tool Co District Warehouses
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WHY NOT, BOSS? STANDARD SHIELD BRAND TOOLS ARE AVAILABLE COAST TO COAST. THEY HAVE A NEW SAN FRANCISCO BRANCH.

STANDARD MEANS *Service*

Investigate the time and cost savings that can be realized in your operation by using Standard Shield Brand Tools.

Complete Service Stock—that saves your time. Over 10,000 items carried in stock—supplied by warehouses in principal cities coast to coast. Solves your purchasing problems.

Foremost Quality—that reduces your costs—because of unexcelled design, material and workmanship.

Reliable Performance—that speeds your production. Proved because Shield Brand Tools have been specified and used in every industry since 1881.

Call your Industrial Supply Distributor for prompt, accurate and reliable service.

STANDARD TOOL CO. CLEVELAND 4, OHIO

New York • Detroit • Chicago • San Francisco

STANDARD TOOL CO.

THE STANDARD LINE: *Drills • Reamers • Taps • Dies • Milling Cutters • End Mills • Hobs • Counterbores • Special Tools*

RCA speeds production, cuts cleaning costs on a wide range of metal parts . . . with

Courtesy: Radio Corporation of America, Camden, N. J.

VAPOR DEGREASING

From fabricated steel racks . . . to aluminum microphone castings . . . all kinds of parts made of all types of metals are cleaned quickly and economically by vapor degreasing in the Camden plant of the Radio Corporation of America.

In 1940, RCA replaced the hand cleaning of its electronic equipment parts with this speedy modern method. The trichlorethylene solvent, supplied by equipment manufacturers under various trade marks, has proved highly efficient in the removal of oil, dirt, and grease from even the most intricate parts. The work is degreased before and after machining and finishing . . . is delivered clean and dry, ready for inspection or further processing. As a result, RCA has been able to speed up production, yet hold down its cleaning costs.

The increased production and reduced operating time realized at RCA may indicate the possibility of more efficient cleaning with vapor degreasing in your plant. An investigation of this rapid, thorough and economical method will prove to you why it is being used by thousands of plants to clean work ranging from watch springs to machine housings.

USE DU PONT TRICHLORETHYLENE DEGREASING SOLVENT

Thousands of manufacturers are using Du Pont Trichlorethylene for vapor degreasing.

Under various trade marks, Du Pont degreasing solvents have been widely used for many years. These solvents are stable . . . the best yet developed by Du Pont for metal degreasing. They stand up against contaminating and destructive materials which may be introduced in degreasing . . . assist materially in carrying out efficient cleaning.

Tune in Du Pont "Cavalcade of America" Tuesday nights—NBC coast to coast

non-
DU PONT *flammable* SOLVENTS
for VAPOR DEGREASING
SOLD NATIONALLY THROUGH DISTRIBUTORS

DU PONT
REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

SEND FOR HELPFUL FREE LITERATURE

These three booklets will give you detailed information on the advantages of vapor degreasing, the equipment, industrial applications, and the Du Pont degreasing solvents.

Mail the coupon today!

E. I. du Pont de Nemours & Co. (Inc.)
Electrochemicals Dept., Wilmington 98, Del.

Please send me your free literature covering the vapor degreasing process and solvents. We are interested in cleaning _____ products.

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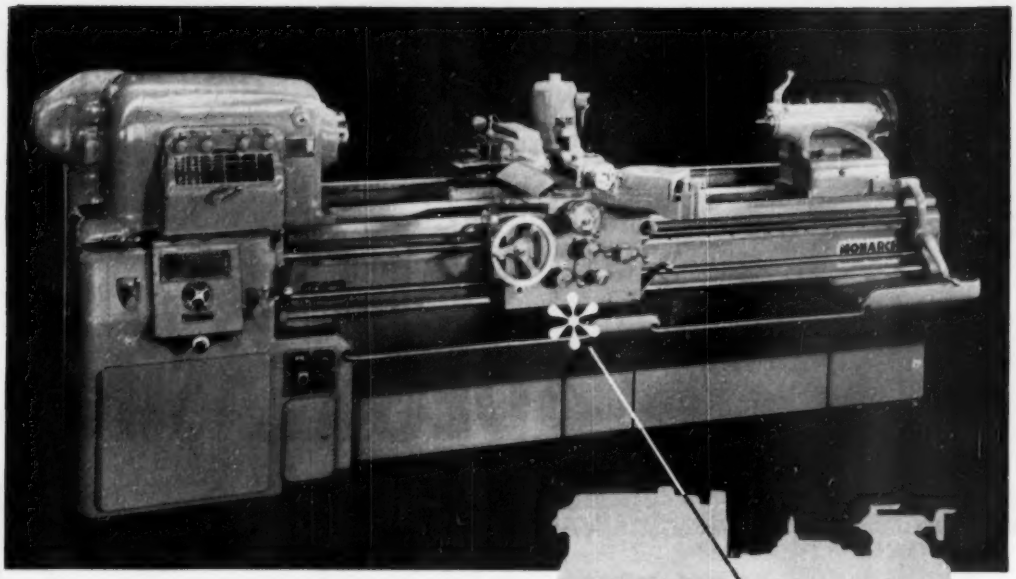


—REPLACEMENT— pays off these 3 ways

If you're attempting to compete in today's metal turning market with any but the latest methods, you're penalizing yourself. Here's why your competitor can underbid you:

1. Faster Production—Through Carbide Tooling. Modern lathes are built for these higher speeds. They have the greater strength required; heavier beds, larger spindles, more power built in. And they wear longer, too—automatic lubrication, more hardened parts, more anti-friction bearings take care of that. *All these are characteristics of modern Monarch Lathes.*

2. Lower Production Costs, for Both Large and Small Lots—Through Tracer Controls. Gone is the necessity for large lots in order to enjoy the savings of automatic duplication of parts. With single-point tracing from a master, you can turn out two parts—or two hundred thousand—in a fraction of the former time, at a fraction of the former cost. *Monarch has had 20 years' pioneering experience in the development and application of tracer controls.*

3. Longer Life and Greater Accuracy—Through Greater Accuracy of Manufacture and Assembly. Over the years, improved manufacturing methods have brought improved products—and nowhere is this more true than with machine tools, "the master tools of industry". Your own products can be only as accurate as the in-built accuracy of your lathe. *When you buy a Monarch you buy the best.*

* * *

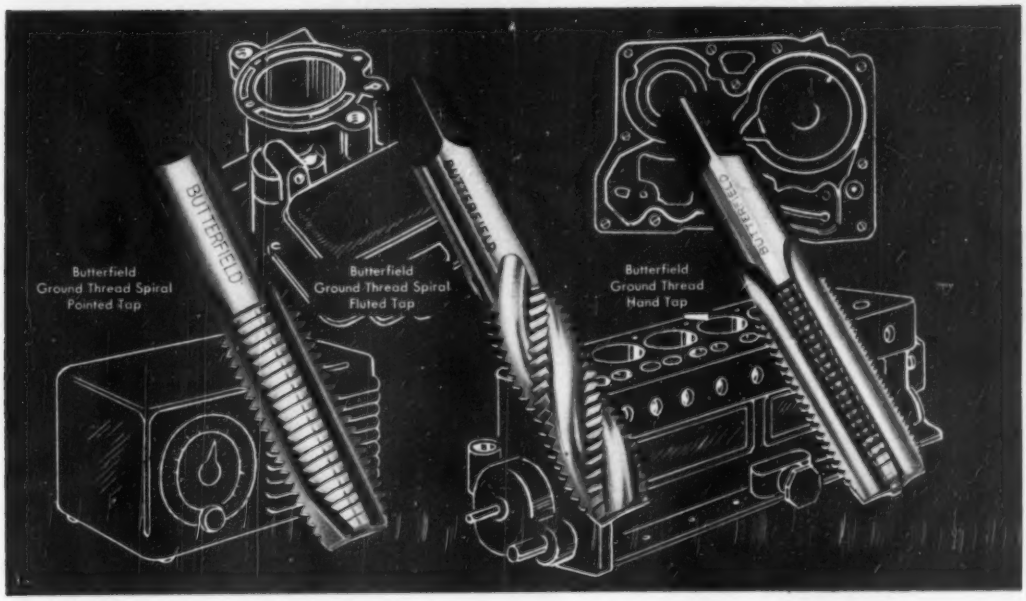
Each lathe bearing the Monarch monogram is distinguished by all three of these advantages. Ask for descriptive literature on the types of machines that interest you.

ACCURACY · ECONOMY · LONG LIFE
Monarch
TURNING MACHINES

How long has it been since you examined your own metal turning capacity in the light of the increased profits possible through replacement?

THE MONARCH MACHINE TOOL CO. Sidney, Ohio

These Butterfield Taps



take to every type of material

Yes . . . whether you work with steel, cast iron, plastic, aluminum, magnesium or any other metal, you can rely on Butterfield for a clean-cut tapping job. Butterfield taps are available in designs best suited for each of these materials. Like all Butterfield tools, the taps are individually inspected. They are also ground thread assuring you maximum accuracy and savings by fewer wasted parts.

Insist on Butterfield Taps for dependable performance. ***Prompt delivery from your nearby Butterfield Distributor.*** Union Twist Drill Company, BUTTERFIELD DIVISION, Derby Line, Vermont. *In Canada:* Rock Island, Quebec.

OPERATOR HERE CHECKS thread form and lead on a Hartness Comparator — magnification 62½ diameters.

BUTTERFIELD

THE 100% INSPECTED TOOLS

Every Tool Individually Inspected

TAPS • DIES • REAMERS • SCREW PLATES

See Osborn's complete line of industrial brushes at the National Metal Exposition, Chicago, Illinois. October 23 — 27, Booth No. 319.

Obtaining bids and delivery promises from each possible source
Constant checking on unknown manufacturers and suppliers
Authorizing payment of individual invoices and preparing separate company checks for each source of supply
Interviewing representatives to check quality of independent makes
Maintaining an inventory of brushes and office records for stock control
Preparing individual requisitions and typing separate orders for each source

YOU SAVE ON THESE HIDDEN HOURS...

when you buy supplies from a trusted source ...YOUR INDUSTRIAL DISTRIBUTOR!

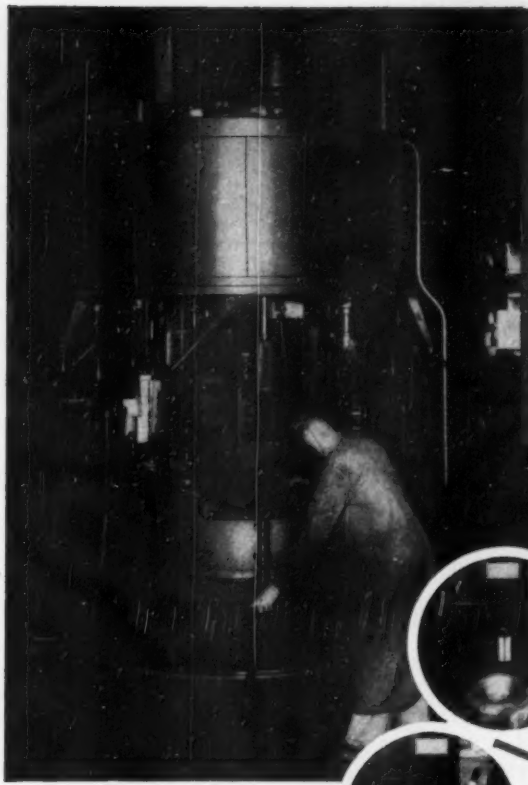
YOUR purchasing department is making big dollar savings . . . continually . . . when it devotes its manhours to *big-volume, basic purchases.* And you do *your* part to free it of routine recurring mill supply orders when you simply specify:

"BUY FROM INDUSTRIAL DISTRIBUTOR"

Buying then is on an economical basis. Many purchasing operations are eliminated. All orders for maintenance brushes, drills, abrasives, belting, etc. can be grouped. You are assured reputable, high-quality brands. Delivery is prompt. Your inventory can be lower.

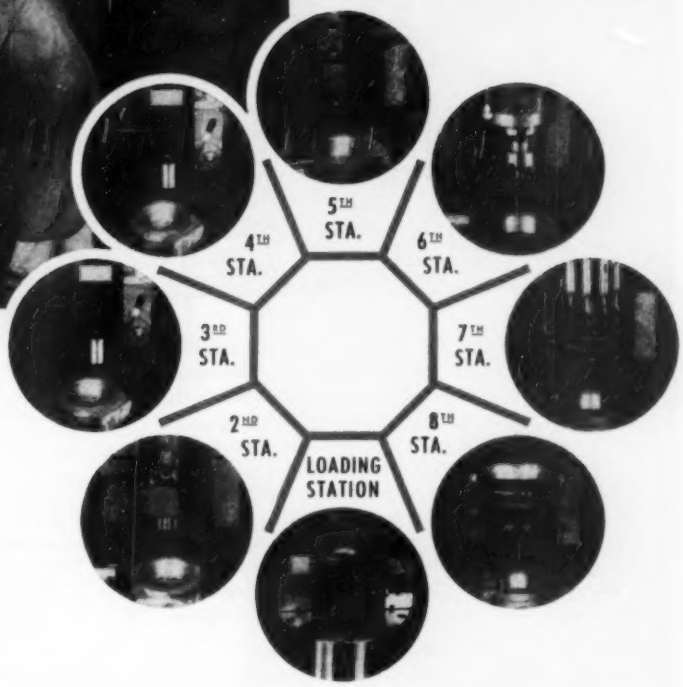
Remember . . . more than 200 leading Industrial Distributors in about 300 locations throughout the U. S. give you a trustworthy source of OSBORN brushing tools . . . a complete line of top-quality floor brushes, paint brushes and other maintenance brushes . . . built for industry by the company that knows industry's problems. *The Osborn Manufacturing Co., Dept. 345, 5401 Hamilton Ave., Cleveland 14, Ohio.*

LOOK FOR THE NAME OSBORN **RECOGNIZED EVERYWHERE FOR QUALITY WORKMANSHIP AND MATERIALS**



A KEY UNIT TO LOWER COSTS

Whether Mult-Au-Matics are tooled for Versatility on a variety of the shorter run jobs or tooled for volume production, users have for many years proclaimed these machines "Key units in lowering our manufacturing costs".



1st Station—:
Loading

2nd Station—:
Rough Bore—Three Diameters

3rd Station—:
Rough Face—Three Surfaces

4th Station—:
Finish Face—Three Surfaces

5th Station—:
Finish Bore—Three Diameters and Chamfer

6th Station—:
Precision Bore—Two Diameters

7th Station—:
Multiple Drill—Ten Holes

8th Station—:
Multiple Tap—Ten Holes

Many of today's economic problems are being solved through lower manufacturing costs. A Mult-Au-Matic installation may be the solution to some of YOUR PROBLEMS.

Let Bullard engineers study your manufacturing methods with a view towards reducing your manufacturing cost via the Mult-Au-Matic Method. Write for Mult-Au-Matic "Pictorial".

THE BULLARD COMPANY

BRIDGEPORT 2, CONNECTICUT

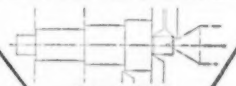
ONE MAN OPERATES 2 DUOMATICS

LODGE & SHIPLEY Duomatic productivity is illustrated in this typical automotive set-up. The operator starts the first Duomatic on its cycle. While this machine operates automatically, the same operator easily handles a cycle on the other Duomatic. Production *flows* from both 2A Duomatics!

The low-cost, precision production of Lodge & Shipley 2A Duomatics is a valuable weapon in the fight against mounting costs. Are *your* lathes operating profitably? Lathes only a few years old may be badly outmoded when compared with new Duomatics *on a productive basis.*

- ★ **Turn and bore with front and rear tool slides.**
- ★ **Swivel tool slides for angular facing and turning.**
- ★ **Simplicity of set-up reduces set-up time.**
- ★ **NO CAMS REQUIRED for automatic cycle.**
- ★ **Ideal for long or short runs.**
- ★ **Easily handled by unskilled operator.**
- ★ **New hardened steel bedways and cross slide ways—add years of life.**

Duomatic At Right: *Floor-to-floor time: 55 seconds; Nine tools turning SAE 8620 steel.*



Duomatic At Left: *Floor - to - floor time: 45 seconds; Four tools turning SAE 8620 steel.*

Let a Lodge & Shipley Representative show you!
Write for 2A Duomatic Bulletin No. 635.

THE **Lodge & Shipley** COMPANY

MACHINE TOOL DIVISION • 3055 COLERAIN
CHOREMASTER DIVISION • 800 EVANS ST.
CINCINNATI 25, OHIO

HERE'S THE ULTIMATE IN

AIR CYLINDER POWER

• • •

The BELLOWS AIR MOTOR

Built-in Electrically-Controlled Directional Valve

•

Built-in Piston Rod Speed Controls

•

Requires only a Single Air Connection

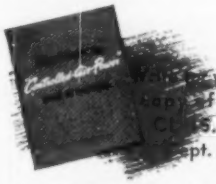
Model illustrated — Electrically controlled BEM-5-40 2½" bore, 4" stroke air motor.

The Bellows Air Motor combines air cylinder, electrically controlled air-powered directional valve, and two independent piston speed controls all in one integral power unit . . . a unit that requires only a single air connection which can be made with flexible hose.

Here's compactness and flexibility to the N'th degree. The Bellows Air Motor makes designing for electrically-controlled air operation simple. No bulky power solenoids. No cumbersome, clumsy piping. No complex air circuits.

The unique Bellows Electroaire valve gets away from bulk and weight by using the air-power itself to shift the valve, tiny built-in 8-volt solenoid controls to direct it. Makes the whole set-up safe from electrical hazard, safe to operator, safe to machine. The Electroaire valve will operate submerged, flooded with coolant, piled high with chips or dust. And the tiny solenoid control units are guaranteed against burnout!

Integral construction means *quick, responsive power, controlled power, safe power.* For any air cylinder operation the Bellows Air Motor offers maximum effectiveness, minimum over all cost.



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The Bellows Co.

AKRON 9, OHIO

FIELD ENGINEER OFFICES IN ALL PRINCIPAL CITIES

Manufacturers of "Controlled-Air-Power" Devices, including conventio[illegible] work feed tables, air-powered machine tool feeds, air-operat[illegible]

for BEST RESULTS in cutting the new

HIGH HEAT RESISTANT ALLOYS

specify

MO-MAX COBALT TOOL BITS

Where the going is rough, MO-MAX Cobalt High Speed Ground Tool Bits often give results that cannot be matched by other tool bits. The new high heat resistant alloys are a case in point. Few if any metals are as difficult to machine . . . yet, in many of these materials, test after test has demonstrated that MO-MAX Cobalt will do the job successfully. If you have a problem in machining these or other types of ferrous and non-ferrous alloys, a *Cleveland* Service Representative will be glad to give you helpful suggestions. Contact our nearest Stockroom, or . . .

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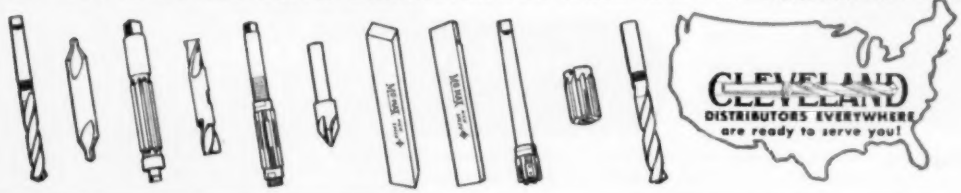
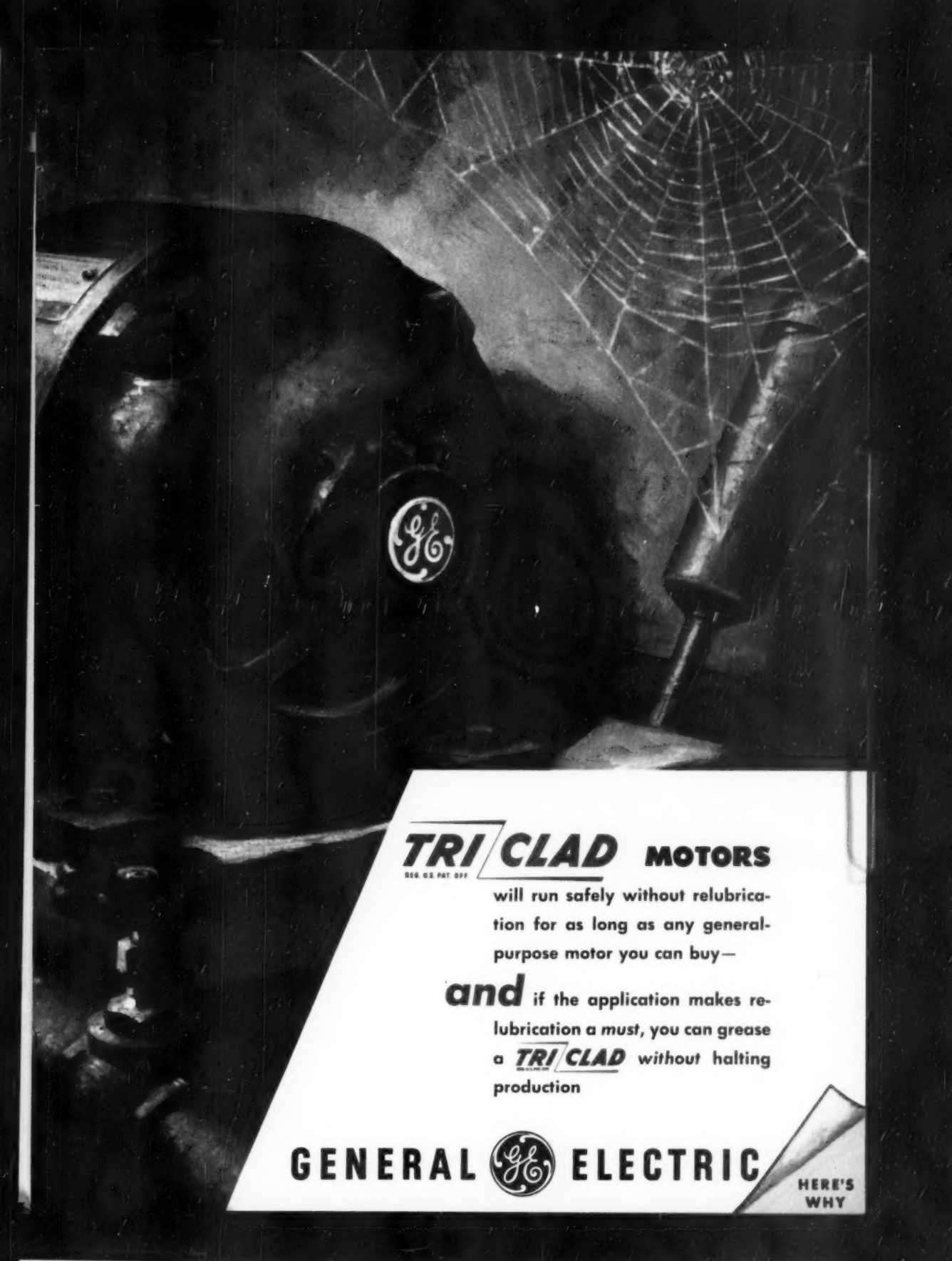
1242 East 49th Street • Cleveland 14, Ohio
Stockrooms: New York 7 • Detroit 2 • Chicago 6 • Dallas 1 • San Francisco 5 • Los Angeles 58
E. P. Barrus, Ltd., London W. 2, England

ASK YOUR INDUSTRIAL SUPPLY DISTRIBUTOR FOR THESE AND OTHER *Cleveland* TOOLS




TRI CLAD MOTORS
REG. U.S. PAT. OFF.
will run safely without relubrication for as long as any general-purpose motor you can buy—
and if the application makes relubrication a must, you can grease a TRI CLAD without halting production
GENERAL ELECTRIC
HERE'S WHY

TRI CLAD MOTORS will run safely without relubrication for as long as any general-purpose motor you can buy—

Tri-Clad extra lubrication "protection" can save you money because:

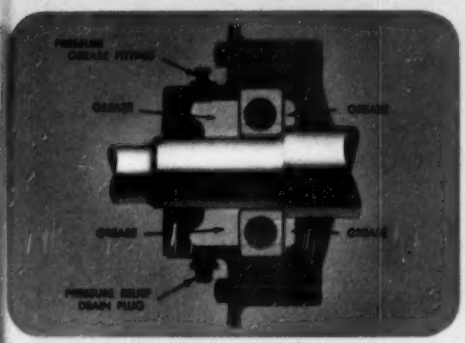
1. Tri-Clad's oversize grease reservoir and the heaviest standard-service bearings mean you do not have to bother with greasing between motor check-ups.

2. When relubrication is needed on those tough applications, you can grease a Tri-Clad without interrupting production-line operations.

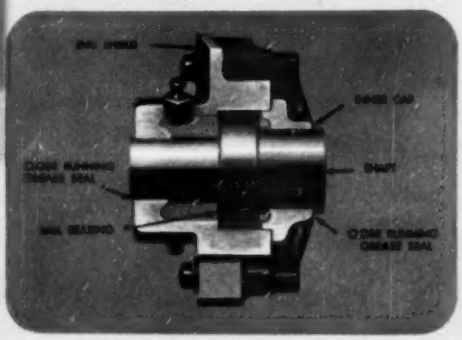
Tri-Clads are grease-gun easy to lubricate *on the job*. Moreover, a Tri-Clad motor will run safely where an ordinary motor would fail. Chances are you'll be spared the cost of a "special" motor.

YOU BE THE JUDGE! The best way to prove to yourself that Tri-Clad gives you the most for your motor dollar is to contact your local G-E office. Tri-Clad stocks are complete. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

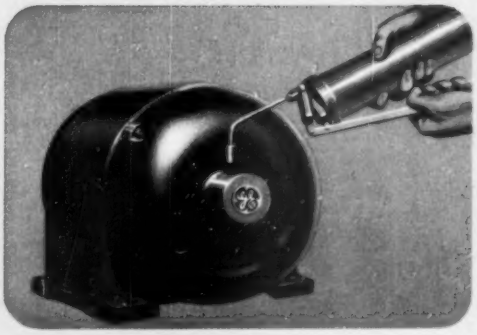
1 **EXTRA BEARING PROTECTION** — Tri-Clad gives you extra bearing protection because heaviest standard-service bearings are carefully selected to withstand severe loads for long periods.



2 **EXTRA GREASE** — Four times the ordinary amount of grease is packed into the large Tri-Clad grease reservoir. Since bearing life depends on grease, this means that Tri-Clad motors will run safely for years — for as long as any general-purpose motor you can buy.



3 **SEALED-IN BEARINGS** — Bearings and grease are completely sealed in a cast housing with long running seals for extra protection from dirt, dust, and lubricant leakage.



4 **PRESSURE-RELIEF GREASING** — An efficient system of pressure-relief lubrication (with standard fittings) enables a Tri-Clad motor to be quickly and easily greased on the job when and if it's needed.

GENERAL ELECTRIC

752-3

When it comes to cutting metal . . .

INDUSTRY COMES TO

ATKINS

only ATKINS makes "Silver Steel"

HACK SAWS, MILLING SAWS, FILES

A saw — any saw — can be only as good as the steel and the workmanship that go into it! And that's why ATKINS saws are so outstanding . . . because they are made of the finest, toughest steel ever formulated for the purpose! . . . and because ATKINS, through many years of research and *learning by doing*, has acquired the "know how" to produce cutting tools that stay sharp longer, that cut faster, that greatly reduce maintenance and operating costs!

of all fine saws . . . .
the finest are "Silver Steel" saws

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AAA ATKINS

NIAGARA PRESENTS

a complete new line of

SOLID ONE-PIECE Steel Frame Presses

Straight Side, Double Crank

Made in sizes up to the maximum that can be shipped on a freight car. (Larger sizes are four-piece tie rod construction).

Furnished with Niagara Air Actuated, Electrically Controlled Sleeve Clutch on sizes up to 6½" shaft. Plain or single geared, single end drive.

Furnished with Niagara Pneumatic Friction Clutch on sizes 4½" to 12" shaft. Single geared or double geared, single, end or twin drive.

Made in lengths up to 96" between gibs. (Longer lengths are tie rod frame construction).

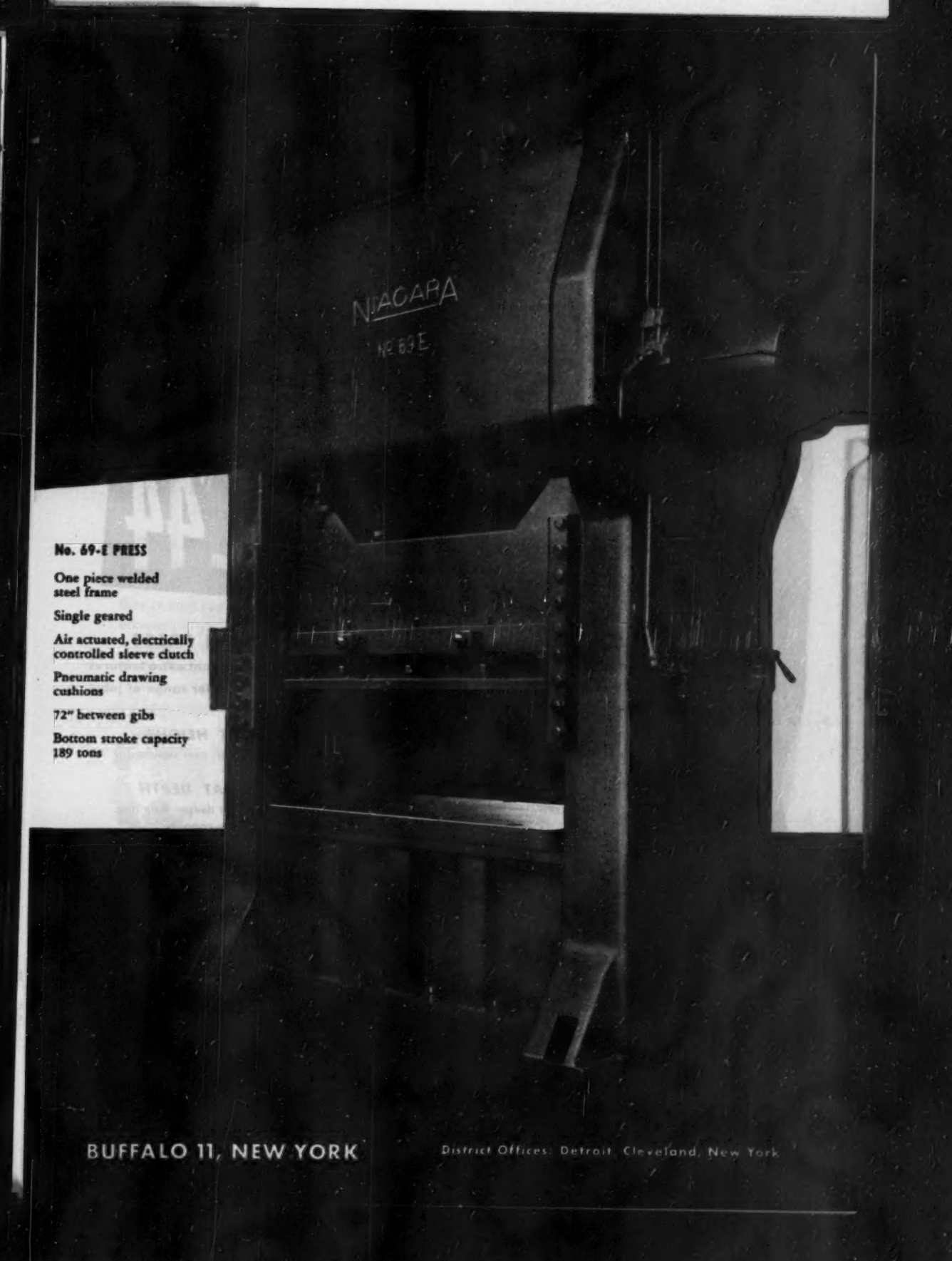
Niagara Pneumatic drawing cushions available.

Write for specifications on sizes to fit your requirements.

MANUFACTURERS OF

Presses, Shears, Machines and Tools for Plate and Sheet Metal Work.

NIAGARA MACHINE AND TOOL WORKS,



No. 69-E PRESS

One piece welded steel frame

Single geared

Air actuated, electrically controlled sleeve clutch

Pneumatic drawing cushions

72" between gibs

Bottom stroke capacity 189 tons

BUFFALO 11, NEW YORK

District Offices: Detroit, Cleveland, New York

Introducing FEDERAL "44"

NEW 35-TON PRESS
designed with important *extra* features
— to handle a wider range of jobs!

★ **EXTRA *SHUT HEIGHT***
— available 1" to 10" over standard

★ **EXTRA *THROAT DEPTH***
— 11½" deep — that's deeper than any Federal of comparable capacity

★ **EXTRA *LONG STROKE***
— any stroke from 1" to 8" is available

plus other well-known Federal qualities

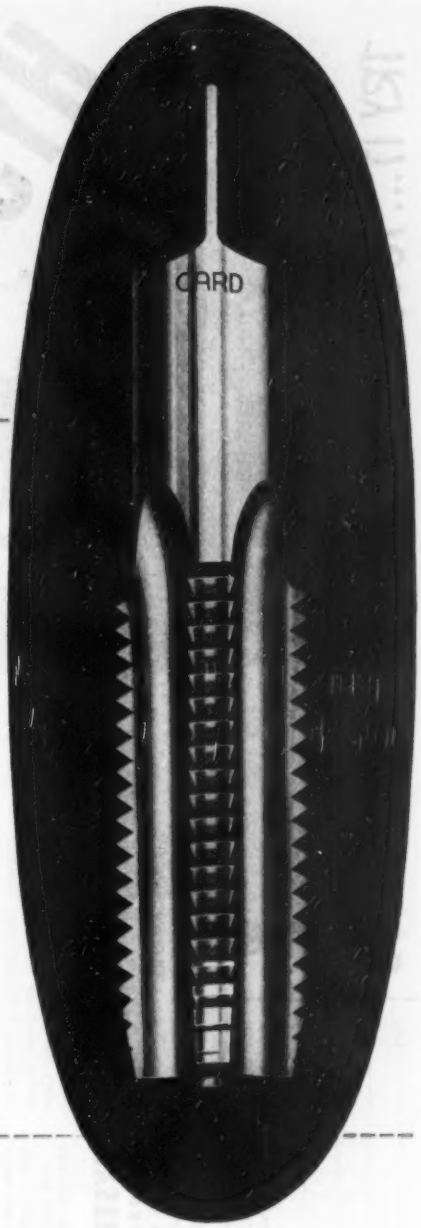
Write for new catalog showing entire line — sizes 6 to 80 tons

FEDERAL PRESS COMPANY, 501 DIV. ST., ELKHART, IND.

FEDERAL *Open Back Inclinable* PRESSES

25 YEARS OF QUALITY CONSTRUCTION

CARD
Ground Thread
TAPS



Standardized Accuracy... At Ordinary Tap Cost!

Card's extreme care in maintaining utmost accuracy is a *plus* that lifts Card Certified* Taps away above the ordinary. Costing no more than run-of-the-mill taps, they're your best possible buy for dependability and long, economical use.

Card Taps are available in both commercial ground and precision ground threads.

When precision ground is required, be sure to specify the limit number.

Your nearby Card Distributor will be glad to supply you with these accurate, top quality taps — and to cooperate with you in every way. Contact him for prompt, helpful service.

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TAPS

The Certified Cutting Tools*

*by the Pittsburgh Testing Laboratory

Also makers of DIES • SCREW PLATES
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S.W. CARD

MANUFACTURING COMPANY
Mansfield, Massachusetts
DIVISION OF UNION TWIST DRILL COMPANY

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THE **ENDURANCE** OF A CAMEL

THE **STRENGTH** OF AN ELEPHANT

HYSTER KARRY KRANE

- Pneumatic tires—works anywhere indoors or outdoors.
- Adjustable boom—5 positions.
- Trunnion steering, maximum maneuverability.
- Speeds up to 10 mph in either direction.
- 10,000 lbs. hoisting and transporting capacity.

HYSTER KARRY KRANE is a terrific cost-cutter in lifting and moving heavy or bulky materials up to 10,000 pounds in weight.

This mobile crane works on pneumatic tires, with standard automotive controls. Does anything (within its capacity) that any overhead or stationary crane or hoist can do. Goes anyplace to do its work—over rough or smooth roads—indoors or outdoors. Great tool for loading and unloading gondolas, flat cars, trucks and vans; for factory and yard materials handling operations.

Typical users include—Automobile factories—Contracting and general construction firms—Heavy machinery distributors—Factories—Food manufacturers—Foundries—Mining—Motor freight lines—Public utilities—Railroads—Warehouse and storage firms—and many other industries where the lifting and transporting of heavy loads is of prime importance.

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Gates

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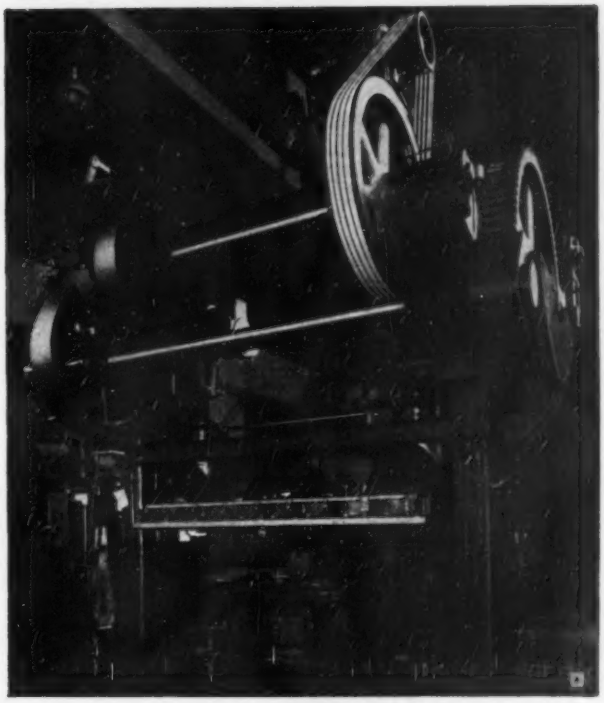


The output of this press was seriously bottlenecked by slipping of the short center flat belt with which it was formerly equipped. The Gates Vulco Rope Drive shown has completely overcome the difficulty. The original belts, after more than 4½ years of service, are still going strong.

Let this simple test tell you exactly WHY the Concave Side cuts your V-Belt costs

To see for yourself the belt-saving importance of the Concave Side, just pick up *any* V-belt and bend it as it bends when it goes around a pulley.

As the belt bends, grip its *sides* firmly with your fingers. You will feel the sides of the belt *change shape*. This is because the top of the belt is under tension and, hence, grows *narrower* while the body, under compression, *bulges out*. (See figure 1 and 1-A)

Now look at figures 2 and 2-A. There you see how the bending changes the shape of the belt that is built with the Concave Side —The Gates Vulco Rope. The concave sides of this belt merely *fill out* and become perfectly *straight*. There is no side-bulge. This belt, when bent, *precisely fits its sheave groove.*

A very distinct saving in belt wear results. No side-bulge means that the sides press *evenly* against the V pulley and therefore wear *uniformly*—resulting in longer life for the sidewall and, naturally, *longer life for the belt!*

If you care about cutting your belt costs, it will pay you to make sure, whenever you buy V-Belts, that you get the V-Belt with the Concave Sides...the Gates Vulco Rope!

What Happens When a V-Belt Bends

Straight-Sided V-Belt

How Straight-Sided V-Belt Bulges in Sheave-Groove. Sides Press Unevenly Against V-Pulley Causing Extra Wear at Point Shown by Arrows.

Gates Vulco Rope with Concave Side

The Concave Side Fills Out to a Precise Fit in the Sheave Groove. No Side Bulge! Sides Press Evenly Against the V-Pulley—Uniform Wear—Longer Life!

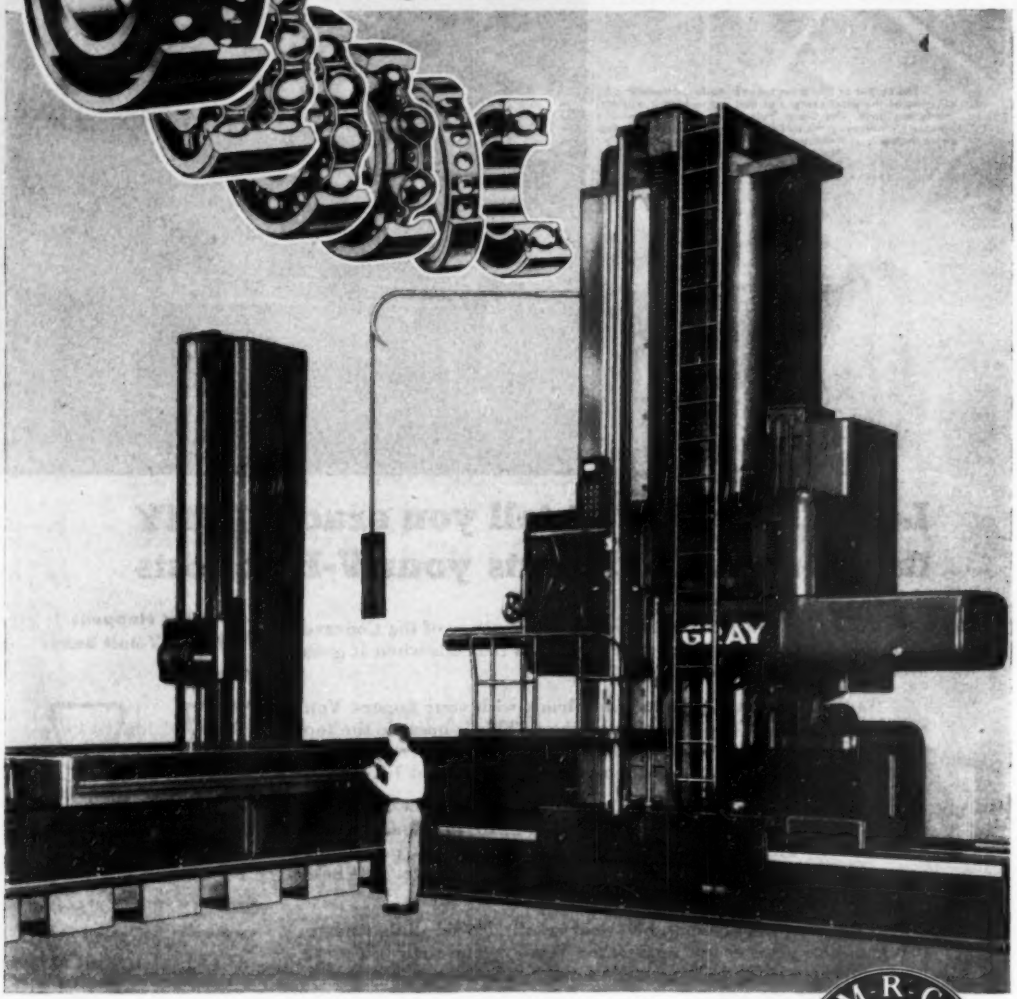
CS-508

THE GATES RUBBER COMPANY
DENVER, U.S.A.
World's Largest Makers of V-Belts

GATES VULCO ROPE DRIVES
Engineering Offices and Jobber Stocks IN ALL INDUSTRIAL CENTERS of the U.S. and 71 Foreign Countries

75 M-R-C Ball Bearings

contribute to the efficiency of one of the largest machine tools built in recent times



New GRAY 8" PLANER-TYPE HORIZONTAL BORING, DRILLING AND MILLING MACHINE.
This 175 ton machine is capable of supporting castings weighing 85 tons.
Manufactured by G. A. Gray Co., Cincinnati, Ohio for Hydraulic Press Mfg. Co., Mt. Gilead, O.

M-R-C Strom SRB GURNEY BALL BEARINGS

MARLIN-ROCKWELL CORPORATION
Executive Offices: JAMESTOWN, N. Y.

Schooled to serve you...

YOU benefit when these men go to school!

These men are Standard Oil lubrication specialists, skilled and experienced in the use of modern lubricants. They are representative of the groups who come year after year from Standard Oil Company (Indiana) sales fields throughout the Midwest to learn about new machinery and the most up-to-date methods of lubricating them. In lecture rooms and in well-equipped laboratories, they are taught new ways to raise economy and efficiency of your operations.

The benefits held out to you by these lubrication specialists are multiplied by a service-distribution set-up that is unique in the oil industry. To serve your midwest operations, Standard Oil has located practically right in your own backyard a completely stocked warehouse and the office headquarters for a lubrication specialist. The nearness of this service-supply center *means faster deliveries to you* of necessary fuels and lubricants. It assures you of getting the product you need when you need it. It puts the services of the lubrication specialist at your immediate disposal.

These advantages are well worth investigating. Arrange, now, for the visit of a lubrication specialist. If your plant is located in any of the states below, simply phone your nearby Standard Oil service-supply center or write to: Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

3 IMPORTANT ADVANTAGES

Standard Oil's Lubrication Service is especially geared to serve your midwest operations.

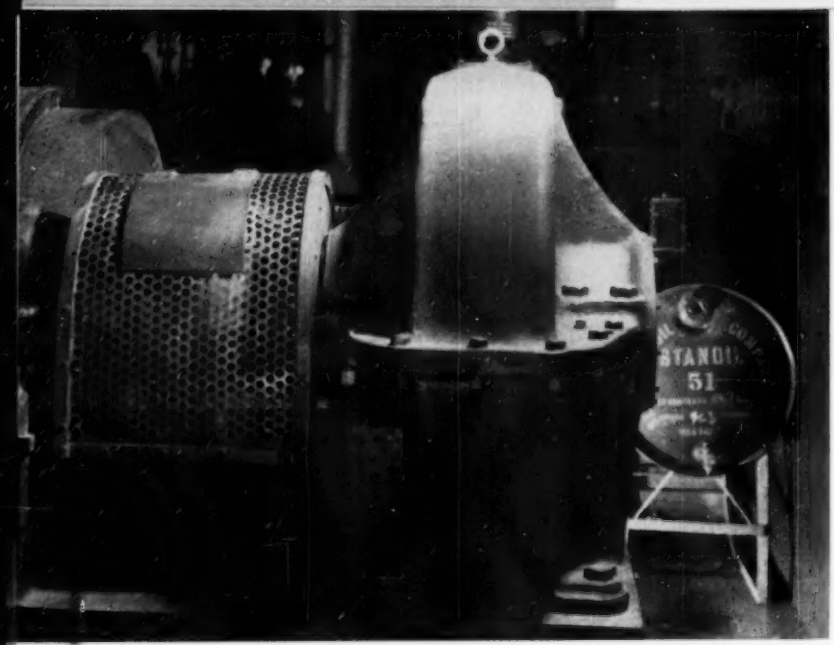
1 SERVICE-SUPPLY POINTS are near your plant. You are assured of fast deliveries, prompt lubrication engineering service.

2 LUBRICATION SPECIALISTS have been specifically trained in Standard Oil Lubrication Engineering Schools to help you obtain the maximum benefits from lubricants and fuels.

3 RESEARCH AND TECHNICAL FACILITIES are geared to help solve your specific lubrication problems.

Colorado, Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Montana, Missouri, Nebraska, North Dakota, Oklahoma, South Dakota, Wisconsin, Wyoming

STANDARD OIL COMPANY (INDIANA) STANDARD



Arrest the dirty work in reduction gears

THE dirty work starts in reduction gears when the lubricating oil begins to oxidize and break down under the attack of heat and air. Oxidation products, uniting with dust and other foreign matter, form deposits which interfere with proper lubrication and cause gear wear.

STANOIL
TRADE MARK
Industrial Oil

You can head off this dirty work—avoid costly cleaning jobs, oil changes, and gear wear—by using STANOIL Industrial Oil. The high stability of STANOIL prevents deterioration by heat. Its low-carbon-forming base oil keeps gears free from carbon. An inhibitor curbs acidity growth which would cause the formation of emulsions and sludge.

The many qualities of this one oil enable it to handle a wide variety of jobs in your plant. To assure you maximum benefits from STANOIL and other high-quality petroleum products, the Standard Oil Company has a well-trained and experienced lubrication specialist located practically at your doorstep. How you can profit by this unique product-service combination is explained at the right.

Standard Oil Company (Indiana), 910 S. Michigan Avenue, Chicago 80, Illinois.

What's YOUR problem?

• To help you solve particular lubrication problems or gain greater all-around economy, Standard Oil has set up an industrial service that's unrivalled in the Midwest. This service puts at your immediate disposal the help of a highly trained, experienced lubrication specialist and a reliable supply of petroleum products. All you need do is phone or address a card to the nearest Standard Oil Company (Indiana) office. In fact, why not start right now by arranging for the visit of the lubrication specialist assigned to your plant. With his help, find how many different oils in your plant can be replaced by STANOIL Industrial Oil on such applications as:

Hydraulic systems...cleaner operation, no foaming troubles

Air compressors . . . no sticking or clogging of valves, less oil consumption in splash or circulating systems.

Speed reducers . . . less wear of gears and bearings during frequent cold starts or prolonged high-temperature operation.

Steam turbines . . . freedom from emulsions and sludge, fewer oil changes necessary.

Ring-oiled bearings . . . rings function immediately on starting, less bearing wear.

Circulating and bath systems ...one oil for a wide variety of jobs.

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You Get L-O-N-G-E-R DIE LIFE with V&O LONG SLIDE PRESSES

Available in Sizes from 3 to 105-Ton Capacity

Cost conscious . . . production-wise press men will tell you: the easiest route to more profitable stamping operations is via *long slide* V & O precision-built Power Presses. Each and every V & O Power Press — be it one of the Standard or T-Line Inclinable types, Double Action, Stockmaster or Bench Presses — is the end result of more than 60 year's experience in designing and manufacturing power presses for a complete cross-section of mass-production, metal-working industries. Rest assured — the V & O that you select to fit your needs will have all the advantages of sound engineering, proper selection of materials, careful workmanship and close inspection. Write today for illustrated catalog, or — better still — let us have one of our representatives call at your convenience.

the V&O PRESS COMPANY
DIVISION OF HARTFORD-EMPIRE COMPANY
HUDSON, N.Y.

3 advantages you can bank on

WHEN A DAKE ELEC-DRAULIC PRESS GOES INTO YOUR SHOP

1. Make parts as you need them
2. Eliminate delay waiting for suppliers
3. Amazing reductions in cost

To date, the rugged 50-ton press that you see in the picture has saved Trans-World Airlines thousands of dollars in their overhaul and modification base.

The Elec-Draulic Press not only reduced manufacturing costs but proved to be ideal for short-run production because slow deliveries were eliminated.

For example: Over $5000 was saved on the manufacture of certain parts stamped from stainless steel. The original bid of $7600 for labor and material was reduced to $2400 by using the Dake Elec-Draulic Press. A Booster Tank that originally cost $80 was turned out on the Dake for $14. An air scoop stamping, whose original cost was $12, came off the Dake for less than $1.00.

When management and men meet a Dake, history records many moneysaving, in-plant experiences. The illustrated folder describes the complete line of Dake Presses, their easy operation and cost-cutting possibilities. You will find it interesting and profitable reading.

Write for this Folder

Dake Engine Company, 636 Seventh St., Grand Haven, Mich.

DAKE arbor and hydraulic PRESSES

Single Leverage Press

Ratchet Type Single Leverage Press

Combination Ratchet & Compound Leverage

Elec-Draulic Press

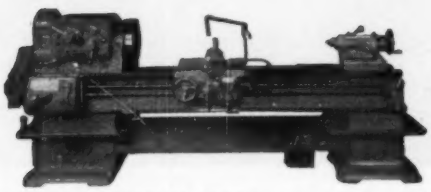
Hand-Operated Hydraulic Press

SPRINGFIELD

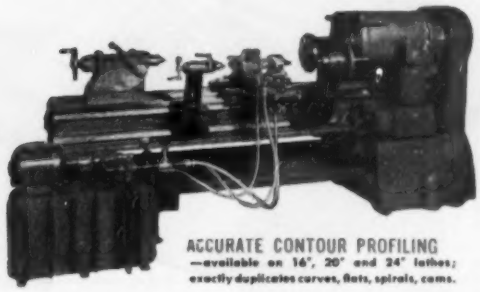
Geared Head
LATHES

Springfield builds a complete line of precision, high quality, geared head lathes. Every type of lathe built by Springfield is especially designed and constructed to meet all the requirements of modern tooling, and to retain extreme accuracy through many years of full capacity production.

Write for catalogs and detailed specifications.

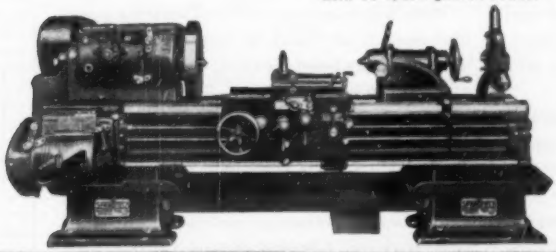


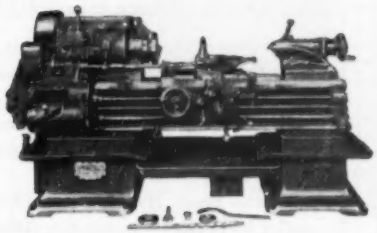
MANUFACTURING LATHE
—with unusually wide applications; capable of accurately turning, boring and facing.



ACCURATE CONTOUR PROFILING
—available on 16", 20" and 24" lathes; exactly duplicates curves, flats, spirals, cams.

SUPER DUTY LATHES
—made in 20" and 22" sizes; equipped with 16-speed geared heads.

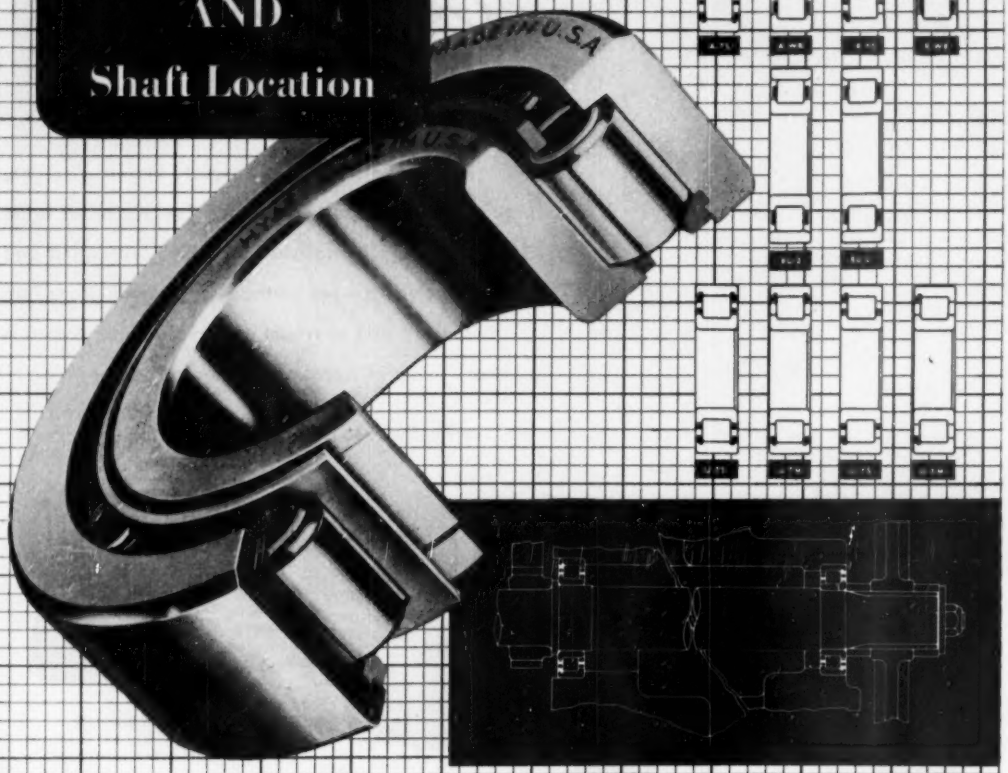




TOOL ROOM LATHES
—made in all sizes including 24"; equipped with lead screw reversing mechanisms.

THE SPRINGFIELD MACHINE TOOL COMPANY
SPRINGFIELD, OHIO, U. S. A.
GENERAL DISTRIBUTORS: BRYANT MACHINERY & ENGINEERING COMPANY, 400 WEST MADISON ST., CHICAGO 6
Exclusive Representatives in All Principal Cities

Hy-Load Capacity AND Shaft Location



The cut-away bearing illustrated is an "R-YS" type Hyatt Hy-Load Bearing. It not only provides the high radial capacity of a cylindrical roller bearing but when mounted in pairs, opposed as shown in the drawing above, will also locate shafts.

In the Hyatt Hy-Load line of cylindrical roller bearings there are ten different types, each designed to fulfill specific application needs. Of these ten types, four are made with separable inner races, two with separable outer races and four are non-separable, thus permitting wide flexibility in machine design and assembly procedures. A wide range of sizes are made in every type.

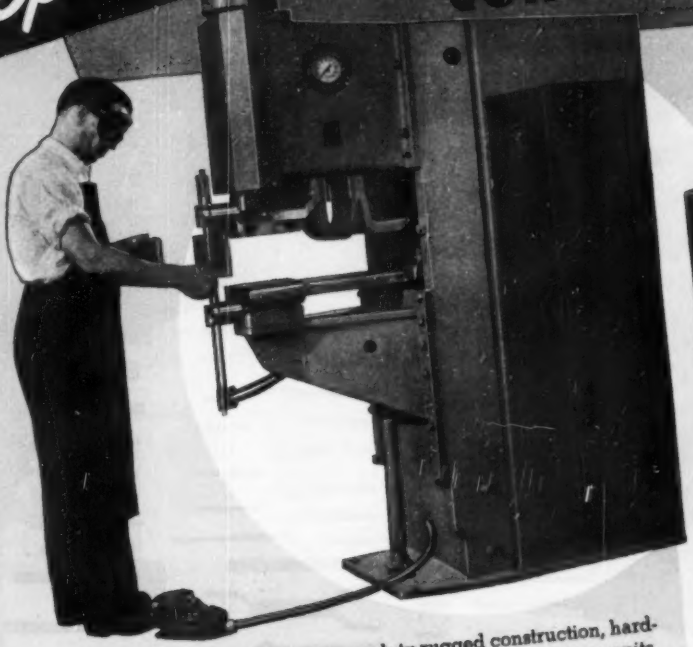
With this large selection of bearing types and sizes from which to choose, a designer can find a Hy-Load Bearing to fit almost any application need.

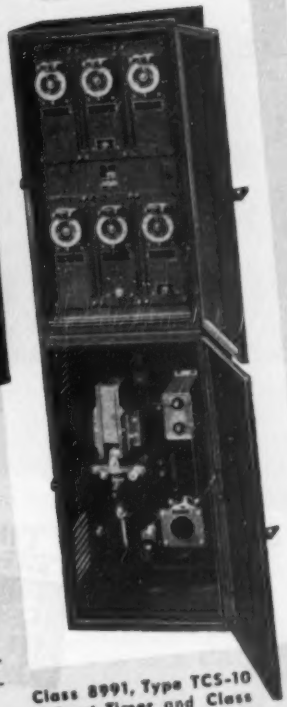
• • •

Full information about Hyatt Hy-Load Roller Bearings is contained in our Catalog 547 . . . a complete engineering guide to radial bearing selection and use. Hyatt Bearings Division, General Motors Corporation, Harrison, New Jersey.

HYATT ROLLER BEARINGS

Specify.. SQUARE D Safront RESISTANCE WELDER CONTROL





FOR CONTINUOUS PRODUCTION—heavy duty rugged construction, hardened moving parts, and accurate, dependable pneumatic timer units.

FOR OPERATOR SAFETY—Safront panel construction isolates individual timer adjustments from live parts. Transformer provides 110 volts for all control circuits.

FOR MOUNTING FLEXIBILITY—Dimensions are standardized. Timers and contactors can be mounted in four different positions for wall or machine mounting.

FOR LOW INSTALLATION COST—Matching knockouts permit close coupling of enclosures, eliminating need for conduit run between contactor and timer.

FOR SIMPLIFIED MAINTENANCE—Accessible mechanical parts and easy coil replacement reduce "down" time and maintenance costs.

Class 8991, Type TCS-10 Safront Timer and Class 8990, Type SCG-2 Syncro-Break Contactor arranged for wall mounting. The same size, neat appearing enclosure is used for 4 and 6 period Safront timers and sizes 1W and 2W Syncro-Break contactors.

When extreme precision or speed is required—use Square D's Electronic Welder Control. Write for Bulletins 8990-8993 which detail the complete Square D line, magnetic and electronic. Address Square D Company, 4041 N. Richards Street, Milwaukee 12, Wisconsin.

SQUARE D COMPANY

DETROIT · MILWAUKEE · LOS ANGELES

SQUARE D COMPANY CANADA LTD., TORONTO • SQUARE D de MEXICO, S.A., MEXICO CITY, D.F.

NAZEL HAMMERS

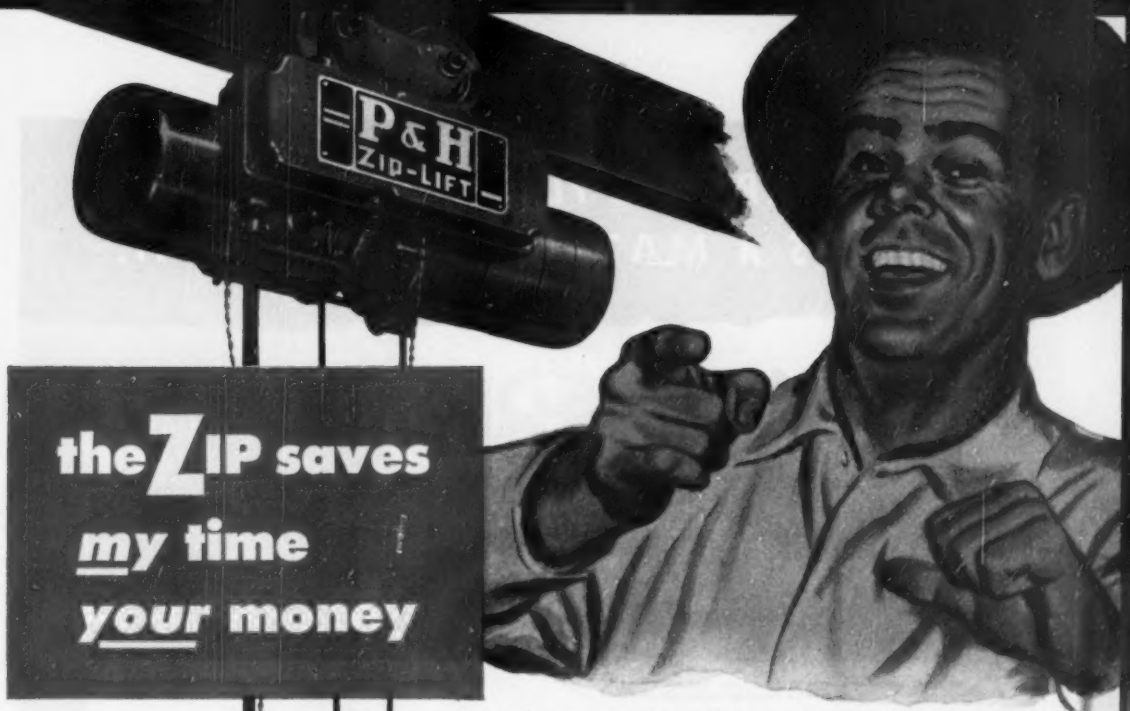
at
BALTIMORE TOOL WORKS
1110 HACK STREET • BALTIMORE, MARYLAND

"... Only because of the performance of this hammer, have we been able to lay a claim to producing the bulk of Star Drills in this country. Were it not for the adaptability and accuracy of your hammer, we would not be able to manufacture the many intricate types of electric and pneumatic shank tools required by manufacturers.

Our praise is not only for the ability of this piece of machinery to forge to plus or minus .003" but also for the tremendous amount of service we obtain without 'down time'."

NAZEL — THE MOST WIDELY USED AIR-ACTUATED, MOTOR-DRIVEN FORGING HAMMER IN THE WORLD.

LOBDELL UNITED COMPANY
A SUBSIDIARY OF UNITED ENGINEERING AND FOUNDRY COMPANY
1836 WILMINGTON 99, DELAWARE 1950



That's the big thing about this little hoist!

Skilled workers should never be allowed to heave heavy loads by hand. Let them put their time and effort where they belong—in production.

In thousands of plants "thru-the-air" handling with the Zip-Lift is saving time—earning money... beside machine tools, along assembly lines, around loading docks, receiving rooms, warehouses—wherever the handling of loads up to 2,000 pounds can be turned into a push button job.

What are your chances for making money with the Zip-Lift? Any P&H Representative will show you where—and how—and how much profit it will earn for you.

Meanwhile, bulletin H20-4 may help you. It's filled with money-saving ideas. Write for it. Use the coupon below.

P&H ZIP-LIFT

Handle it "thru-the-air" at lower cost

These added values make the P&H Zip-Lift

America's most popular little wire rope electric hoist

SAFER — 110 volt push-button control. No open wiring. Plugging type limit switch; double brakes.

LIFETIME CONSTRUCTION — Precision built — shaved gears running in oil — grease-sealed antifriction bearings — fully enclosed, moisture-proof, dust-proof, acid-proof. Motor designed for hoist service.

ALERT SERVICE — Out-of-stock delivery from qualified dealers everywhere — also backed by 19 branch offices and conveniently located warehouses.

And Now . . . Still More New Features — All Standard Equipment

- Lower limit stop — meets all safety codes.
- Extra ground conductor in feeder cable and push button pendant.
- Reinforced push-button pendant.
- Grooved drum for longer cable life.

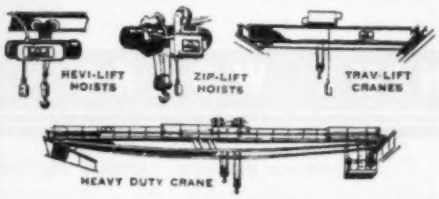
Available in capacities up to 2000 lbs.

P&H ELECTRIC HOISTS

4514 W. National Ave.
Milwaukee 14, Wis.

HARNISCHFEGER
CORPORATION

EXCAVATORS • OVERHEAD CRANES • HOISTS • ARC WELDERS and ELECTRODES • SOIL STABILIZER • CRAWLER and TRUCK CRANES • DIESEL ENGINES • CANE LOADERS • PRE-ASSEMBLED HOMES



HARNISCHFEGER CORPORATION
4514 W. National Ave., Milwaukee 14, Wis.

Gentlemen: Please send me your Bulletin H20-4 on the Zip-Lift.

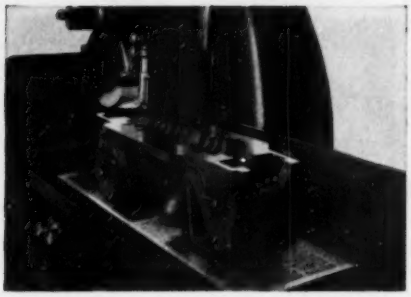
Name.....

Company.....

Address.....

City.....Zone.....State.....

WHERE THERE IS A FLAT SURFACE TO GRIND THERE'S A MATTISON TO GRIND IT.



40 hours before — now 4 hours. Pump case ground on Mattison Horizontal Spindle Precision Surface Grinder.

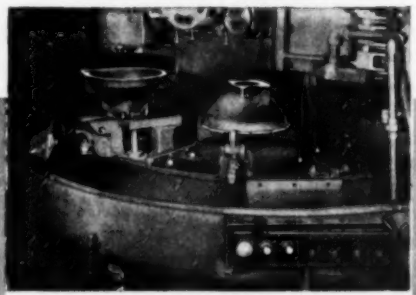
700 connecting rods per hour, using 40 station fixture to finish grind crank and wrist pin end of assembled rod with Mattison No. 72 Grinder.

With the addition of the production grinding machinery formerly made by the Hanchett Manufacturing Company, Mattison is now in a position to work with you on all your surface, face and disc grinding problems. These machines are made in various types to handle a wide range of work. Experienced engineers are available to give you best production efficiency, finish and tolerances, with Mattison machines.

For any flat grinding ask for our recommendations on the proper method and machine for your job. No obligation, of course.

For catalogs on any of the types shown or if you would like a copy of the general bulletin, let us know and we'll gladly send them to you.

Grinding Cast-Iron Cams — 5" diameter, 1½" thick — stock removal, each side .030". Production 120 surfaces per hour on Mattison (Hanchett Type) Rotary Surface Grinder.



200 Transmission Case surfaces ground per hour on Mattison (Hanchett Type) Rotary Automatic Grinder. A special 8-station mechanical fixture permits one operator to grind each end of this large 35 lb. casting, flat and parallel. Stock removal .050".

320 surfaces of cast iron compression heads per hour, removing 1/32" stock with Mattison No. 24 Rotary Surface Grinder.

MATTISON MACHINE WORKS

ROCKFORD · ILLINOIS

Dollar and Cents Angle

on Fafnir Sealed Ball Bearings

Figure it out yourself . . . You may be able to *improve your product* by using one of the several types of Fafnir Sealed Ball Bearings — especially if you make household appliances, electric motors, farm equipment . . . anything which operates intermittently. Sealed to keep lubrication in, dirt and contaminants out, these bearings keep your product running smoother, longer, without attention or breakdowns even when customers neglect it.

You *slash manufacturing costs,* too, because Fafnir Sealed Bearings simplify assemblies, cut out machining operations, and eliminate extra parts otherwise needed to provide and retain lubricants.

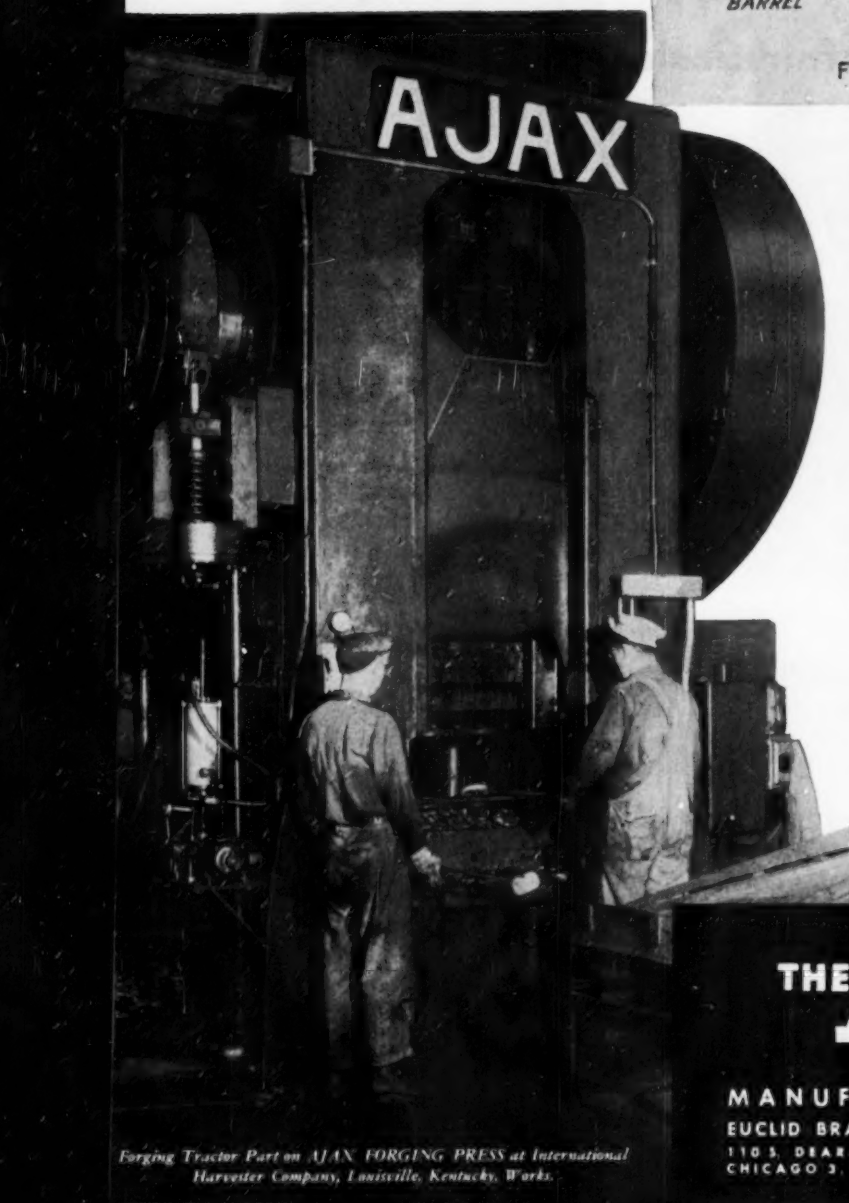
It may *pay you* well to switch to Fafnir Sealed Ball Bearings. Remember, only ball bearings offer this type of self-protection which results in these "dollar and cents" advantages. To find out what advantages Fafnir Sealed Bearings can offer you, call in a Fafnir engineer. The Fafnir Bearing Company, New Britain, Conn.

FAFNIR
BALL BEARINGS
MOST COMPLETE LINE IN AMERICA

PRESS FORGE GEAR BLANKS

better! faster! cheaper!

Dies and Forging Operation for Tractor Gear Blank



Forging Tractor Part on AJAX FORGING PRESS at International Harvester Company, Louisville, Kentucky, Works.

The need of high production efficiency in competitive industry today emphasizes the importance of the economies gained through Press Forging of Gear Blanks, as well as many other types of multi-stage forgings. The forgings are better because they have a high degree of uniformity of size and added strength due to the hot forging process shaping the grain flow so that the finished gear has a stronger structure. Forging is faster, as the quick air clutch controlled press ram achieves so much from a single stroke. And press forging is cheaper through saving in manpower both in forging and in subsequent finishing operations. There is still further saving in metal due to a minimum of flash and in minimum die replacement cost.

Write for Bulletin 75-B

THE **Ajax** MANUFACTURING COMPANY

EUCLID BRANCH P. O. CLEVELAND 17, OHIO

1103 DEARBORN ST. CHICAGO 3, ILLINOIS

DEWART BUILDING NEW LONDON, CONN.

STANDARD ENGINEER'S REPORT

DATA

LUBRICANT Calol O.C. Turbine Oil

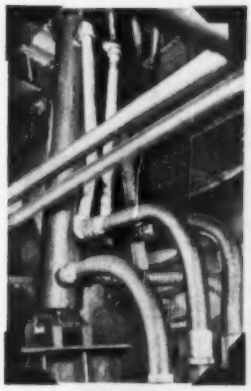
APPLICATION Hydraulic Medium

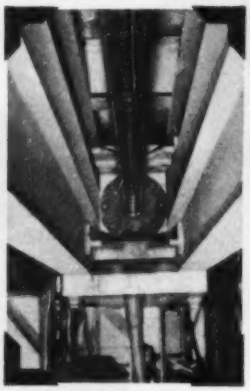
UNIT Hydraulically-operated sawmill-10,000 bd. ft. per day capacity

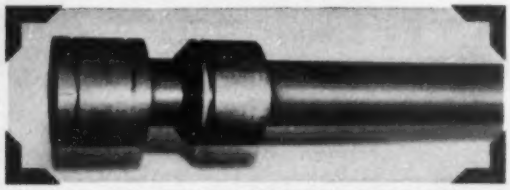
CONDITIONS Extreme temp. and pressures—cyl. + rods exposed to moisture

FIRM Ivory Pine Co. of Calif., Dinuba, Calif.

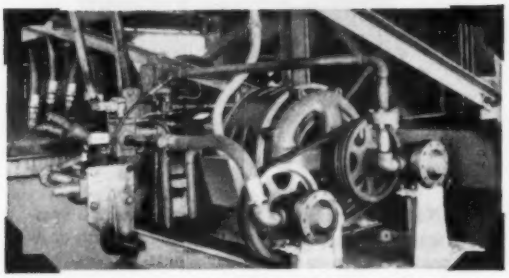
Inhibited oil stops thickening and foaming trouble







CALOL O.C. TURBINE OIL, AS HYDRAULIC MEDIUM in these cylinders, pistons, pumps, etc., operating feed works and other units of Ivory Pine Company's hydraulically-powered sawmill, has prevented any rusting, deposit formation, and leaks caused by foaming, since the mill started. Ordinary oil in similar units knocked out three pumps, lost 175,000 feet production. Note shiny, unrusted surface, and oil on 16' piston rod (left). When photographed, it had been idle in damp, foggy weather for three months!



"IN ALL SIX OF OUR HYDRAULIC SYSTEMS, CALOL O.C. Turbine Oil has eliminated oil foaming and 'jelling' trouble," says Mr. E. P. Ivory, president of the company, "And we've found no rust, even on our lift cylinder at the surface of the log pond."

REMARKS: Developed and built by The Peters Co., Portland, Ore., this new type sawmill is the most complete of its kind. Its logs, cut from a U. S. Forest Service Sustained Yield Unit, are hauled 50 miles to the mill during the summer so it can operate the year around.

How CALOL O.C. Turbine Oil cuts costs in hydraulic systems

Used as the hydraulic medium in feeds and lifts of any kind, CALOL O.C. Turbine Oil will not form carbon or foam excessively.

A. Contains very effective oxidation inhibitor—will not deteriorate and plug lines and retard action of cylinders.

B. Corrosion inhibitor prevents rusting and pitting—has high metal-wetting ability.

C. Separates readily from water or other contaminants—dirty oil may be reclaimed easily...charge lasts indefinitely, leakage only cause for replacement.

FOR MORE INFORMATION about this or other petroleum products of any kind, or the name of your nearest distributor handling them, write or call any one of the companies listed below.

CALOL

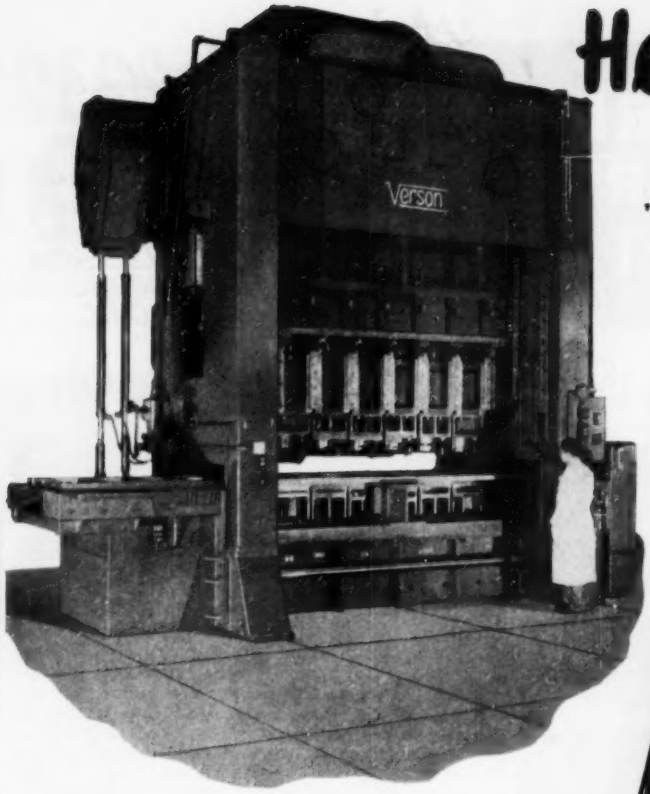
TRADEMARK "CALOL" REG. U.S. PAT. OFF.

STANDARD OIL COMPANY OF CALIFORNIA • San Francisco
THE CALIFORNIA OIL COMPANY • Barber, N.J., Chicago, New Orleans
STANDARD OIL COMPANY OF TEXAS • El Paso, Texas
THE CALIFORNIA COMPANY • Denver, Colorado

Here's what

TRADE **Verson** MARK

TRANSMAT PRESSES will do for you . . .



Illustrated is a 250 ton Verson TRANSMAT Press used by a leading manufacturer of automotive parts for making sealed beam headlight mounting rings. Developed blanks are fed by a Verson Automatic Stack Feed and six operations are performed. Production is 1100 pieces per hour.

- ✓ Eliminate handling, pickling, and annealing between operations
- ✓ Provide greater uniformity
- ✓ Minimize rejects
- ✓ Conserve floor space
- ✓ Free operators for other jobs
- ✓ Minimize scrap loss
- ✓ Reduce maintenance

Since the first Verson TRANSMAT Press was made, over ten years ago, owners have found that these machines are unmatched as cost-cutters where production requirements are high. With the TRANSMAT it is possible to *automatically* draw, form, punch and trim parts from developed blanks or from coil stock, whichever affords the greater scrap economy. As many as ten operations are being performed without intermediate handling . . . one press and one operator doing the work of several in a minimum amount of space. Automatic feeding puts an end to the human errors that accompany hand feeding. Maintenance is limited to a single machine instead of several. Further, the use of TRANSMAT Presses is no longer limited to symmetrical or cylindrical parts. Rectangular and non-concentric parts can and have been successfully produced on TRANSMATS.

If you are a continuous every-day producer of metal stampings in large quantities, we would like to explain the economical advantages of Verson TRANSMAT Presses and Verson Dies. Call us, today.

Originators and Pioneers of Allsteel Stamping Press Construction

VERSON ALLSTEEL PRESS COMPANY

9316 South Kenwood Avenue, Chicago 19, Illinois — Holmes Street and Ledbetter Drive, Dallas 8, Texas

A VERSON PRESS FOR EVERY JOB FROM 60 TONS UP!

BLANKING PRESSES • DRAWING PRESSES • HYDRAULIC PRESSES • HIGH PRODUCTION PRESSES
TRANSMAT PRESSES • PRESS BRAKES • DIES • DIE CUSHIONS • COMPRESSION MOLDING MACHINES

"Visit Our Booth at the National Metal Show"

Rivett offers the Series 9100 Power Unit as the ideal source of power for your hydraulic circuit. The unit is equipped with pump, relief valve, oil filter, pressure gauge, and all equipment to furnish a steady flow of oil at continuous working pressures up to 1000 P.S.I. Reservoir is available in 5 tank sizes, with pump capacities from .4 G.P.M. to 40 G.P.M. Motor mounting may be arranged for any standard frame. Series 9200 with double pumps are supplied for two separate circuits of different pressures.

REMOTE PILOT OPERATED CONTROL (SINGLE PUMP)

Starting the electric motor results in the continuous reciprocating of the cylinder rod. In one position of the Model 5805 Pilot operated 4-Way valve, oil is directed from the pump to the blind end of the hydraulic cylinder, causing the cylinder to extend at its rated speed. When the machine table advances to where it depresses the cam of Model 8630 flow control valve, the forward speed of the cylinder is affected by the setting of the flow adjusting screw of Model 8630 valve. In the other position of Model 5805 valve, oil is directed from the pump to the rod end of the hydraulic cylinder causing it to retract at full rated speed. In this direction of cylinder movement, Model 8630 has no effect on the speed of the cylinder. Model 7205 Pilot valve provides for remote hydraulic operation of the main 4-Way valve, Model 5805. The forward, or return stroke of the cylinder may be manually interrupted at any time by reversing the handle of the Model 7205 Pilot valve.

Write for Catalog showing specifications and description of Rivett Hydraulic Power Units.

RIVETT LATHE & GRINDER INC. • Brighton 35, Boston, Mass.
Department AM 10

WHEN YOU APPLY HYDRAULIC OR AIR POWER *Plan with* **RIVETT**

AIR AND HYDRAULIC VALVES AND CYLINDERS, HYDRAULIC POWER UNITS

Gage Block Set 35A. Larger or smaller sets, and individual blocks, are also available.
Below: Set of Tungsten Carbide Wear Blocks.

NO FINER GAGE BLOCKS ARE MADE

Anywhere in the World

A strong statement — ***but fact!*** Taft-Peirce Gage Blocks are made from the finest alloy steel, carefully hardened and seasoned. Surfaces lapped to the highest degree of flatness and finish insure the ultimate in accuracy and durability. Dimensions, clearly marked on the edges, are always visible when in use — a Taft-Peirce exclusive.

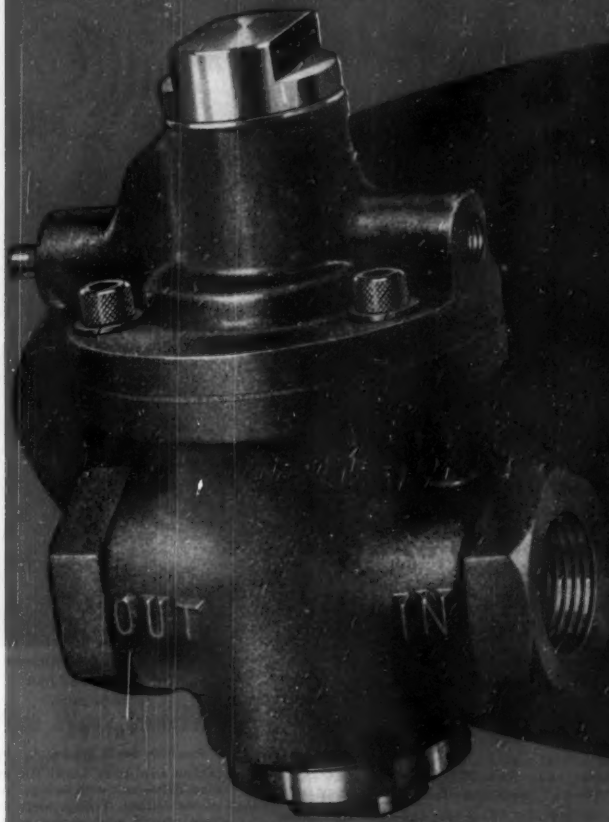
The 35A Gage Block Set permits all dimensions from .300″ to 8.000″ in steps of .0001″ to be obtained—a truly economical set! For a wider range, the 82A Set, consisting of 81 blocks and an extra, measuring .10005″, provides all dimensions from .200″ to 12.000″ in steps of .0001″ and from .300″ to 12.000″ in steps of .00005″. Tungsten Carbide Wear Blocks, measuring .050″ and .100″, are also available to increase the life of any gage block set. Write for more information today.

THE TAFT-PEIRCE MANUFACTURING COMPANY
WOONSOCKET, RHODE ISLAND
Branch offices in all major cities

T-P means TOP PRECISION

Save up to 500 Gallons Per Hour!

New ROSS "Water-Saver" Valve CUTS COOLANT COSTS!



INSTANT CUT-OFF ASSURED

Now waste of expensive coolants can be eliminated their use confined to required periods!

The Ross "Water-Saver" or Time Delay Valve is the answer. It turns on the coolant and lets it run when needed then automatically shuts it off. The flow can be maintained for any period from 3 seconds to 3 minutes after the machine cycle.

Operation of the valve is entirely automatic. No electrical or mechanical motivation is required since it is activated by cylinder pressure.

The Water-Saver Valve is a straightway or shut-off model, normally open or closed to water supply, and is available in ¼ to 1¼ pipe sizes.

Get complete details today no obligation whatsoever.

Ask Ross for Any Air Control Information

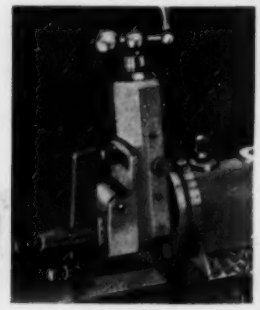
Ross makes valves only—hundreds of types and sizes. Take advantage of the experience gained in over a quarter century of concentration on control and application of air power!

ROSS Air Control VALVES

ROSS OPERATING VALVE COMPANY

120 E. GOLDEN GATE AVE., DETROIT 3, MICHIGAN

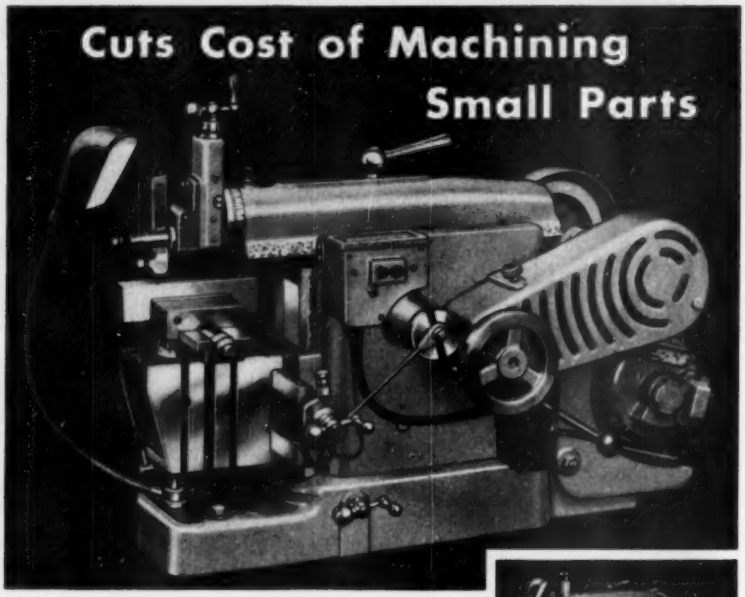
SOUTH BEND 7" PRECISION SHAPER



Tool head locks in any position. Rugged clapper box also adjustable.

Rocker and crank with graduated eccentric adjustment for stroke.

Guards on all belts and pulleys. Quick-acting belt tension release.



Saves Time...Saves Labor

It's fast—accurate—easy to operate. The South Bend 7" Precision Shaper can consistently give you low machining costs on small parts. Designed to handle a wide variety of work in this class, it will enable you to release larger shapers for heavier work, save on machine investment and economize on both power and upkeep. Find out how this versatile shaper can give you better production, toolroom or maintenance machining. *Send coupon for literature.*

SPECIFICATIONS

RAM—Stroke length—0 to 7". Strokes per minute (4)—42 to 195. Cutting speeds—3 to 114 feet per minute.

TOOL HEAD—Vertical feed—3". Swivels—360°. Tool Post opening—13/32" x 7/8".

TABLE—Horizontal travel—9-1/2". Vertical travel—5". Power cross-feeds (6)—.002" to .012". Ram clearance—1/2" to 5-1/2". Table size—5-3/8" x 5" x 6-5/16".

VISE—Jaw width—4". Jaw depth—1". Maximum opening—4". Swivel base.

Steel stand for shaper—3 drawers and built-in chip pan.

PRICES

7" Precision Bench Shaper . . . $468
(Price includes light fixture, vise, drive unit with belt guards, motor pulley, V-belt, switches. Steel stand and motor extra.)
Steel Stand $137.50
Motor—1/3 h.p., 115 v., 1 ph., 60 cy., A.C. **$36.05**

Prices f.o.b. factory
Time Payments Available

SOUTH BEND LATHE
SOUTH BEND 22, IND. • *Building Better Tools Since 1906*

Send Information Checked:

☐ 7" PRECISION SHAPER ☐ LATHE ATTACHMENTS ☐ TIME PAYMENT PLAN

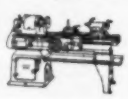
Name_____

Company_____

Street_____

City_____ State_____

☐ 9" and 10" BENCH LATHES



☐ 10" to 16-24" FLOOR LATHES

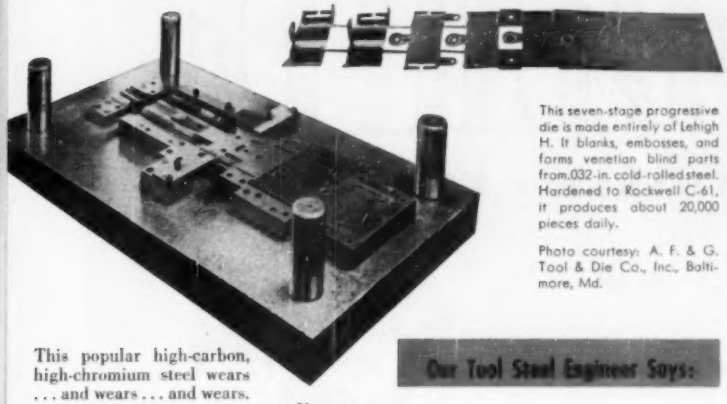
☐ 1/2" and 1" collet TURRET LATHES

☐ 14" DRILL PRESSES

Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

LEHIGH H PRODUCES 20,000 PARTS DAILY FOR VENETIAN BLINDS



This seven-stage progressive die is made entirely of Lehigh H. It blanks, embosses, and forms venetian blind parts from.032-in. cold-rolled steel. Hardened to Rockwell C-61, it produces about 20,000 pieces daily.

Photo courtesy: A. F. & G. Tool & Die Co., Inc., Baltimore, Md.

This popular high-carbon, high-chromium steel wears . . . and wears . . . and wears.

It's air-hardening, of course. Veteran toolmakers like the way it holds the closest dimensions during heat-treatment. It's deep-hardening, too; and has high compressive strength. If there ever was a tool steel made for maximum production, it's Lehigh H!

Detective Work Needed When Dies Fail

Dies that are made from the right tool steel and properly heat-treated will stand a lot of abuse. But there are limits. Just the other day, for example, we saw a broken die made from a reliable grade of tool steel. It was made for blanking pieces from 18-gage sheet steel, and the clearances were carefully designed accordingly.

When the die was delivered to the shop, an over-anxious operator couldn't wait to try it out. His sheet steel wasn't available, but he found a pile of light steel plate and started banging out sample pieces. Result: a broken die.

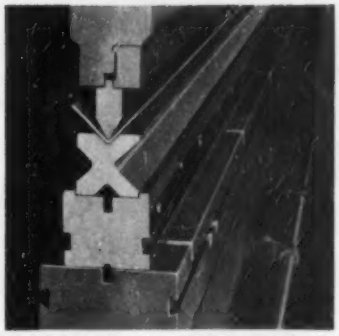
In a case like this, the first impulse is to point an accusing finger at the tool steel. Experience shows, however, that the fault nearly always lies in the design, heat-treatment, grinding, or in the use of the tool or die

Our Tool Steel Engineer Says:

Fresh water is all right for chasers, but don't use it for quenching tools.

Fresh water, regardless of its source, contains dissolved gases which make it unsuitable for the quenching of tools. When tools are quenched in fresh water, gas is liberated at the surface of the tool. Gas pockets thus formed may prevent contact between tool and water to an extent that soft spots are produced as a result of ineffective quenching. Soft spots are undesirable, not only because of their low hardness, but because a quench which produces soft spots is also likely to cause cracking of the tools.

Soft spots, and tool cracking associated with soft spots, can be avoided by quenching in water which has been boiled to remove dissolved gases. If the water cannot be boiled, quench a large amount of hot "dummy" material to expel the gases. It is preferable to use a 10 pct brine solution instead of water as a further precaution against soft spots. Care should also be taken to expel dissolved gases from the brine solution before use.



Typical brake die assembled in a press brake. Bethlehem Brake Die Steel is heat-treated, ready to use, needs no further hardening. It gives long wear, has high tensile strength and plenty of shock-resistance.

Sheet-Metal Brakes Call for Special Brake-Die Steel

Among those people who have sheet-metal brakes in their shops are a few who are accustomed to using just any old steel for their brake dies. They find that they can get a cheap steel to use for this purpose and they see no reason for paying a higher price.

In the long run, these folks will pay a fancy price for the "cheap" steel by the time they get through fussing around with it, doctoring up the ordinary steel to take out the twists and bends. Shop overhead and costs run high these days.

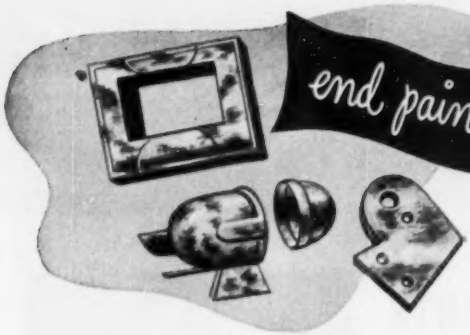
Bethlehem Brake Die Steel is really tops for its special-purpose job.

We stock this steel in standard sizes in our Mill Depot. It's carefully heat-treated, oil-quenched and tempered, then straightened and stress-relief annealed to prevent warping when it's machined by the die-maker. It's engineered to machine easily and to give long wear in service.

The maker of brake dies can machine this fine steel to accurate contour and not have to worry about whether or not it's going to *stay* straight. It's economical to make up into dies because it's heat-treated, ready for use without any further hardening.

Like to know more about it? Write for Folder 560, addressing our nearest sales office or our Publications Department at Bethlehem, Pa.

Bethlehem ULTRASONIC TESTED **Tool Steel**



end paint failures on die castings

BONDERITE

FAST • DEPENDABLE • ECONOMICAL

Die castings and paint need something *between* them to keep *them* together!

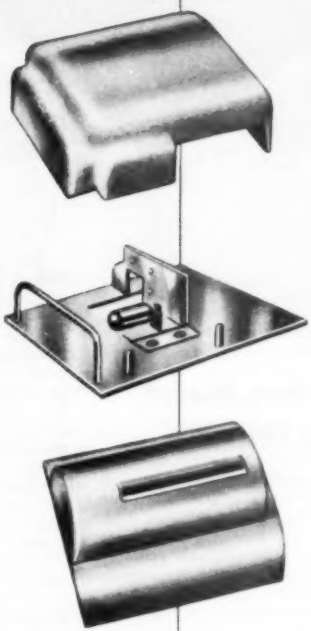
Bonderite creates a layer of nonmetallic crystals on die-cast surfaces; a layer that is part of the metal itself. Bonderite resists under film corrosion, provides a perfect anchor for paint, ends peeling and lifting of the organic finish. Bonderite-treated die castings hold their factory-created fine appearance.

Bonderite treatment prior to painting is simple and uniform in performance, effective in results, economical in cost, and fast enough to match any production line's pace.

Bonderite *your* die castings before you paint.

OUR TECHNICAL BULLETIN TELLS THE STORY

Get full information on Bonderite for die castings. Write today for *Free* technical bulletin.



Bonderite, Parco, Parco Lubrite—Reg. U. S. Pat. Off.

PARKER

PARKER RUST PROOF COMPANY
2186 East Milwaukee Ave.
Detroit 11, Michigan

BONDERITE—Corrosion Resistant Paint Base • PARCO COMPOUND—Rust Resistant • PARCO LUBRITE—Wear Resistant for Friction Surfaces

ANOTHER Machine Tool Made Better with MEEHANITE® *Castings*

(Fig. 1)

The modern streamlined production tools like the Super Service Uprights (Fig. 1), manufactured by Cincinnati Bickford Tool Company, Cincinnati, Ohio, are built with many Meehanite castings. All of the truly *vital* castings are Meehanite metal. A few are illustrated.

In the manufacture and sale of a machine tool of this type it is a long road between the drawing board and the customers' production floor. The correct specification of proper materials for component parts to translate maximum design superiority into product superiority, is of major importance. That is why wherever quality products are built; where better engineering properties combined with uniformity and repeated dependability are required,—Meehanite castings are specified and insisted upon.

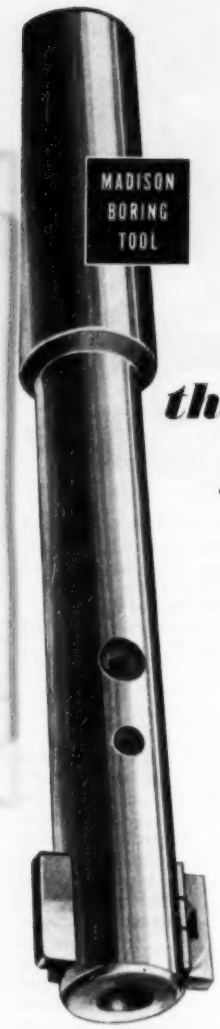
Take advantage of Meehanite engineering service—send your blueprints for analysis and specific recommendation to the foundries listed below.

Take Your Casting Problems To A MEEHANITE Foundry!

American Brake Shoe Co.	Mahwah, New Jersey
The American Laundry Machinery Co.	Rochester, New York
Atlas Foundry Co.	Detroit, Michigan
Banner Iron Works	St. Louis, Missouri
Barnett Foundry & Machine Co.	Irvington, New Jersey
E. W. Bliss Co.	Hastings, Mich. and Toledo, O.
Builders Iron Foundry, Inc.	Providence, Rhode Island
Continental Gin Co.	Birmingham, Alabama
The Cooper-Bessemer Corp.	Mt. Vernon, Ohio and Grove City, Pa.
Farrel-Birmingham Co., Inc.	Ansonia, Connecticut
Florence Pipe Foundry & Machine Co.	Florence, New Jersey
Fulton Foundry & Machine Co., Inc.	Cleveland, Ohio
General Foundry & Manufacturing Co.	Flint, Michigan
Greenlee Foundry Co.	Chicago, Illinois
The Hamilton Foundry & Machine Co.	Hamilton, Ohio
Johnstone Foundries, Inc.	Grove City, Pennsylvania
Kanawha Manufacturing Co.	Charleston, West Virginia
Koehring Co.	Milwaukee, Wisconsin
Lincoln Foundry Corp.	Los Angeles, California
E. Long Ltd.	Orillia, Ontario
Otis Elevator Co., Ltd.	Hamilton, Ontario
The Henry Perkins Co.	Bridgewater, Massachusetts
Pohlman Foundry Co., Inc.	Buffalo, New York
The Prescott Co.	Menominee, Michigan
Rosedale Foundry & Machine Co.	Pittsburgh, Pennsylvania
Ross-Meehan Foundries	Chattanooga, Tennessee
Shenango-Penn Mold Co.	Dover, Ohio
Sonith Industries, Inc.	Indianapolis, Ind.
Standard Foundry Co.	Worcester, Massachusetts
The Stearns-Roger Manufacturing Co.	Denver, Colorado
Traylor Engineering & Mfg. Co.	Allentown, Pennsylvania
Valley Iron Works, Inc.	St. Paul, Minnesota
Vulcan Foundry Co.	Oakland, California
Warren Foundry & Pipe Corporation	Phillipsburg, New Jersey

"This advertisement sponsored by foundries listed above."

MEEHANITE® PERSHING SQUARE BUILDING • NEW ROCHELLE, N. Y.



the "holes in our heads" are full

. . . OF COST-CUTTING IDEAS

Yes, the "holes" in our engineers' heads are full of ideas to give you newer, faster, lower cost methods of boring . . . methods that save you time and money. If your job needs a special bar or special cutter, we'll design and make it. Chances are a standard Madison cutter in the right Madison bar will give you greater production economy. The Madison line, built over a period of thirty-five years, is broad enough to fit nearly any boring requirement. Let Madison's experienced boring specialists . . . the "men with the holes in their heads" . . . help you cut your boring costs. Submit your problems for recommendations by our problem solving tool design department. Of course there's no obligation.

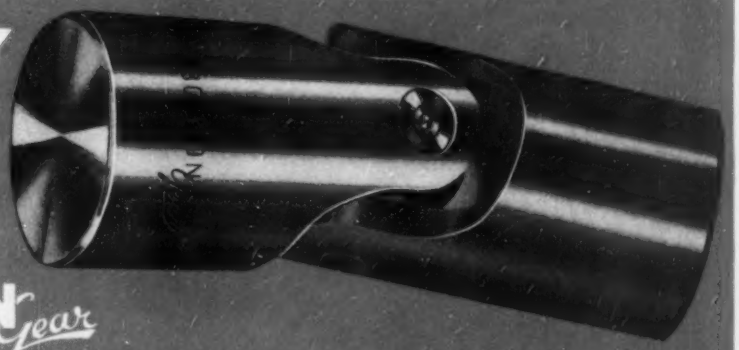
Write for the information filled Madison Catalog. It is yours for the asking.

Tools for rough boring; finish boring; combination rough and finish boring, multiple cutting, bottoming; and other special tools.

MADISON MANUFACTURING CO.

DEPT. AM **MUSKEGON, MICHIGAN**

LUCKILY FOR YOU...

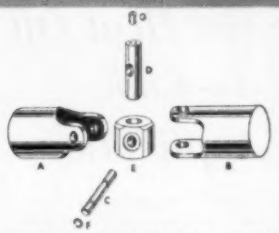


BOSTON Gear

the best Universal Joint is also the Easiest to Get

— best in design — best in quality of materials and workmanship (all parts interchangeable) — best in performance

— stocked in all standard diameters, solid and bored by eighty Boston Gear Distributors, one right handy to you.



WHY BOSTON'S BEST

Boston Gear Universal Joints are engineered for high load carrying capacity and high static torque ratings. They are compact, smooth running, long-lived. They equal or exceed Government Specifications in every respect.

YOKES (A & B) are constructed of highest quality, heat treated alloy steel with bearing surfaces precision ground and O. D. ground to +.000, — .001 for concentricity.

BEARING PINS (C & D) are hardened and precision ground.

CENTER BEARING BLOCK (E) is hardened and precision ground. Holes intersect accurately to provide true bearing surfaces.

SELF-LOCKING ASSEMBLY RING (F) of specially selected spring steel, snap locks into recesses in small bearing pins and center bearing block.

SELF-CLOSING, BALL VALVE OILER (G) provides an oil reservoir for safe, sure lubrication.

THESE PRECISION PARTS ARE INTERCHANGEABLE

BOSTON UNIVERSAL JOINTS, like all of the 101 Boston Gear Power Transmission Products and Parts are readily available from stock at your local Authorized Boston Gear Distributor. Name on request.

FOR COMPLETE INFORMATION on Boston Universal Joint stock sizes, HP ratings and breaking loads consult the new Boston Gear Catalog No. 55. Copy mailed on request.

BOSTON GEAR WORKS

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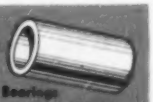
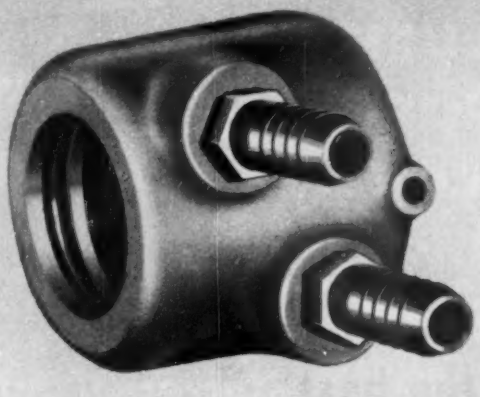


Value Beyond The Purchase



Mallory Cooling Chambers

Special Features of

MALLORY EXTERNAL COOLING CHAMBERS

One-Piece Aluminum Casting

Rubber "O" Ring Seals

Standard Water Nipples

Allen-Head Set-Screw Lock-On

Two Diameters—

⅝", K503509

1¼", K503512

Help take the Heat Off Hard-to-Cool Welding Applications

Many resistance welding applications require extra water cooling of the electrodes in order to obtain long service life at high production rates. Others . . . such as those involving projection welding studs and bolts . . . make it impossible to bring the cooling water in the electrode or die close enough to the welding face to insure satisfactory production.

Mallory offers two external cooling chambers . . . for ⅝" and 1¼" electrodes or dies . . . to supply an independent source of cooling water. Rubber "O" ring seals and standard nipples assure tight connections and facilitate easy set-up.

These standard Mallory chambers are recommended especially for application to internally-cooled electrodes and dies which operate at excessive temperatures. The added cooling capacity lessens down time and lengthens the life of equipment.

That's value beyond the purchase!

Mallory's resistance welding know-how is at your disposal. What Mallory has done for others, can be done for you!

In Canada, made and sold by Johnson Matthey and Mallory, Limited 110 Industry Street, Toronto 15, Ontario

Resistance Welding Electrodes, Holders, Dies, Rod and Bars, Castings, Forgings

SERVING INDUSTRY WITH

Capacitors
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Resistance Welding Materials

P. R. MALLORY & CO. Inc.

MALLORY

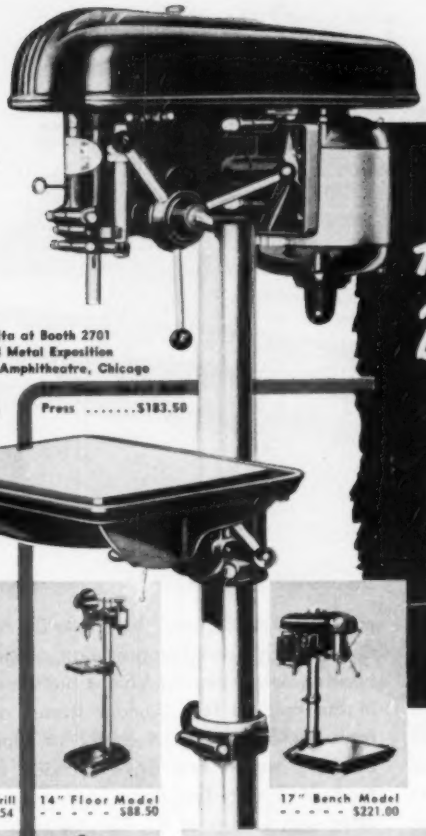
P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

DELTA®
MILWAUKEE

High in Accuracy! Big in Capacity! Low in Cost!

for extra drill-press value, see Delta

the most complete line



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October 23-27, 1950

Press $183.50

14" Super-Hi® Drill Press - - $154.54

14" Floor Model - - - - - - $88.50

17" Bench Model - - - - - $221.00

17" Power-Feed Floor Model $283.50

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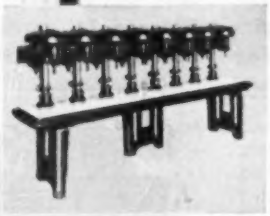

17" Multiple-Spindle (8) - $1804.50

Motor and switch extra in some cases. Prices subject to change without notice.

FOR years, men who know power tools have recognized the Delta Drill Press as the best buy on the market — thanks to the extra quality built into every Delta machine. They have proven it to themselves day after day on tough production jobs.

And you get that extra value in a complete selection. 144 different drill presses to choose from. Floor and bench types, single and multiple-spindle, power feed, foot feed . . . speeds from 385 to 4600 rpm (or 12,000 rpm in Super-Hi models).

What's more, you get the same quality and selection in the other machines that make Delta the most complete line of wood- and metal-working machines — the only line with complete accessories for every tool. Buy Delta — and you buy right!

Sold only through authorized dealers—available on easy time-payments. Look for the name of your Delta dealer under "Tools" in the classified section of your telephone directory.

DELTA POWER TOOL DIVISION
Rockwell Manufacturing Co.
MILWAUKEE 1, WISCONSIN

DELTA • MULTIPLEX • CRESCENT • HOMECRAFT

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53 Machines — 246 Models
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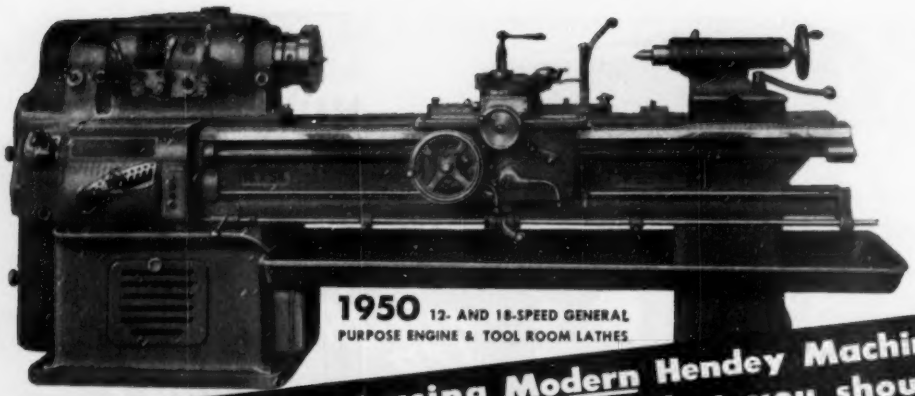
plus 14 Homecraft machines

6 Circular Saws . . . 4 Jointers . . . Scroll Saw . . . 4 Radial Arm Saws . . . 2 Shapers . . . 2 Saw-Jointer Combinations . . . Mortiser . . . Lathe . . . 2 Buffing Machines . . . 2 Planers

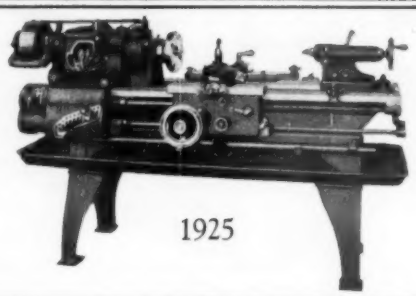


1950 12- AND 18-SPEED GENERAL PURPOSE ENGINE & TOOL ROOM LATHES

. . . If you are not using Modern Hendey Machines you are not earning the profits that you should!

Hendey Engine and Tool Room Lathes have been, and always will be, tops for accuracy. But, are you aware of the many other modern features of the new Hendey line? Like all Hendey Lathes, the 12- and 18-speed now have induction hardened and precision ground bed ways for both carriage and tailstock. Every important unit has fully automatic lubrication. The rear end of the spindle is graduated for indexing when cutting multiple threads, and there are 36 thread and feed changes. The precision, all-geared headstock is powered from a built-in motor in the cabinet leg. Spindle speed ranges from 19-1000 R.P.M. A choice of cam lock or long taper key drive spindle noses. Modern Hendey Tool Room Lathes are available with swings of 9", 12", 14", 16", 18", 20" and 24". Write today for full details and complete specifications.

This 8-speed Hendey Engine Lathe has long been obsoleted by the all-new Hendey 12- and 18-speed lathes. The 8-speed bed is not hardened and precision ground. Maximum spindle speed is only 426 R.P.M. Although a masterpiece of design and construction in its day, the 8-speed has been replaced by progressive manufacturers, because the 12- and 18-speed offer every modern improvement necessary to earn maximum profits.



Continuous, advanced engineering by Hendey is worth watching — and must be watched if you are to earn full profits from your lathes and shapers. For complete particulars and prices, contact your nearest Hendey office.

MODERN Hendey

THE HENDEY MACHINE COMPANY
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BRANCH OFFICES: New York, Chicago, Boston, Detroit, Rochester, Los Angeles, San Francisco
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. . . ask yourself these questions—

1. Why should we use "fortified" hydraulic oils?

2. What oil supplier is the pioneer in such oils?

3. What brand is approved by most makers of hydraulic mechanisms?

4. What one company supplies both hydraulic oils and hydraulic packings?

5. Why should I buy both oils and packings from one source?

1. For longer, trouble-free service, modern hydraulic oils are being fortified scientifically to (a) increase their resistance to oxidation, (b) hold gums in solution until the oil-change period, (c) prevent corrosion of metal parts, and (d) increase the film strength of the oil.

   Results: better indexing, freedom from chatter, cleaner machines, longer oil life.

2. E. F. Houghton & Co. led the oil industry in its pioneering development of treated hydraulic oils.

3. HYDRO-DRIVE Hydraulic Oils are on the approved list of practically all manufacturers of hydraulic mechanisms.

4. Houghton is the only manufacturer of both hydraulic oils and hydraulic packings—leather and synthetic rubber.

5. Houghton makes sure that its hydraulic oils and packings are compatible, that the oil does not adversely affect the packings, and that the packings form perfect oil seals.

Those are good reasons why you should specify "Houghton" for hydraulic design or maintenance. For complete data, call or write E. F. Houghton & Co., 303 W. Lehigh Avenue, Philadelphia 33, Pa. Service and sales in all principal cities.

HOUGHTON'S

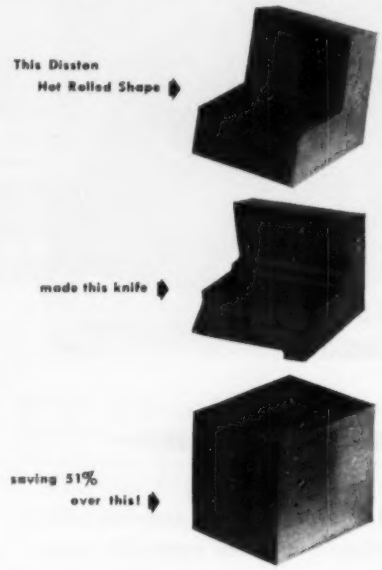
HYDRO-DRIVE HYDRAULIC OILS

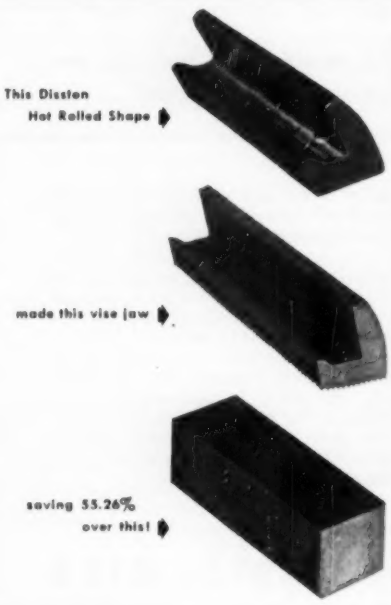
OTHER HOUGHTON PRODUCTS include industrial lubricants, cutting oils, cleaners, heat treating materials, rust preventives.

How to stretch critical tool steels

WITH DISSTON® HOT ROLLED SHAPES

EXAMPLES OF STEEL SAVINGS YOU CAN GET WITH DISSTON HOT ROLLED SHAPES:





Save up to 50%—and more—on the tool steels you now use. And save not only steel, but machining and manpower also!

Disston Shapes can be rolled in a variety of forms to fit your exact specifications. Tolerances are extremely close, and very fine finishes can be furnished. Disston Hot Rolled Steel Shapes can be made in both alloy and carbon steels, in electric and open hearth grades.

Disston engineers and metallurgists will be glad to work with you in developing the special shapes that will give you the greatest economies. Write us, specifying your needs.

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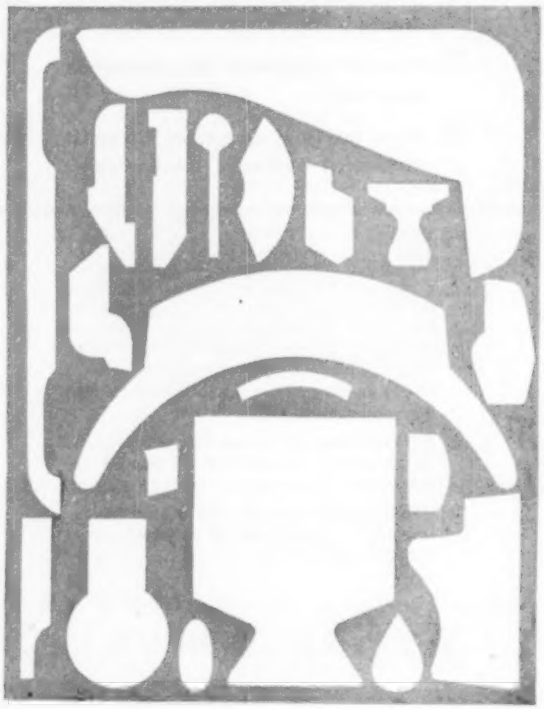
A few of the many forms of DISSTON HOT ROLLED STEEL SHAPES



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MORE PIECES PER HOUR
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Jones & Lamson offers the best investment in turret lathes. They are backed by the "know how" of a firm, long predominant in the field, whose many pioneered and perfected developments have brought about far-reaching advances in the art of cutting metal.

Every feature of these lathes has been developed through long-range research and practical experience in production turning. Their superior performance stands out over any other machine of comparable size, because they are built to hold their accuracy at the highest speeds and feeds possible with modern cutting tools — with ample reserves to anticipate new cutting techniques. Jones & Lamson Turret Lathes have a well-earned reputation for ease of operation, low operating costs and year-round dependability. They are recognized for their advantages in *SPEED, POWER, RIGIDITY AND REPETITIVE ACCURACY.*

They will pay for themselves quickly through savings in direct costs alone!

- Single lever speed selector — 12 spindle speeds 30 to 1500 RPM or 20 to 1000 RPM
- 15 HP constant speed motor — ample horsepower available at all speeds
- Single lever carriage feed selector — 9 reversible longitudinal and 9 cross feeds
- Single lever hexagon turret feed selector — 9 longitudinal turret feeds
- All longitudinal and cross feeds automatically disengaged against positive stops
- Heavy-duty spindle mounting with rugged preloaded anti-friction bearings
- Heat-treated, precision-finished, long-wearing alloy steel gears
- Multiple-disc type forward and reverse clutches — automatic spindle brake
- Husky, multiple-spline transmission shafts with anti-friction bearings
- Hardened and precision ground steel ways — $12\frac{1}{2}$" in overall width
- Bridge-type carriage for multiple tooling at rear of cross slide
- 4-position, quick-indexing square turret — all faces tapped for extra tool blocks
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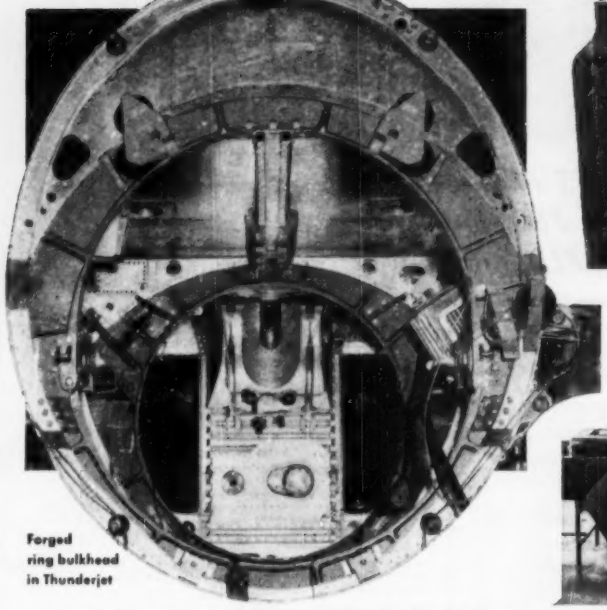
MACHINE TOOL CRAFTSMEN SINCE 1835

Number One of a Series

OK carbide cutters mill vital "Thunderjet" Forgings at Liberty Products, Farmingdale



Forged ring bulkhead in Thunderjet

REPUBLIC AVIATION'S F-84 Thunderjet doesn't have room in the fuselage to carry the wing spar straight through. Hence, box-section wing spars must be attached to connection points on either side of a forged-steel ring bulkhead. This assembly literally holds plane together, besides mounting the engine.

To get adequate strength in this vital bulkhead, Republic Aviation specifies a chrome-moly steel heat-treated to 180,000 psi and a hardness of Rockwell 40 C (375 Brinell). In milling abutting ends the two half-ring forgings that are spliced to make the bulkhead, Liberty Products Corporation uses OK carbide-tipped cutters exclusively. In fact, this Farmingdale, L.I. plant has standardized on OK cutters for all of its many milling operations.

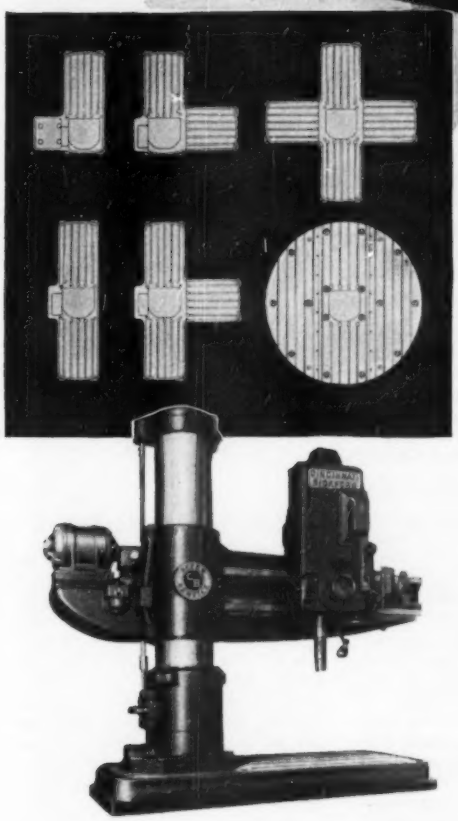
In the setup shown, a 6-in. dual-adjustable face mill with negative rake and carbide-tipped blades is being used to finish the ends of an I-section ring forging. Two of these forgings are later spliced top and bottom and an accurate fit is required. Two roughing cuts and one finishing cut are taken on each piece, at a feed rate of 5.5 in. per min. At a spindle speed of 251 rpm., the chip load per tooth figures out at 0.0022 in., which is very good considering the physical properties of the material. Furthermore, 6 pieces are produced per cutter grind.

Like Liberty Products, you too can enjoy the advantages of standardizing on OK cutters. The wedge-shaped blades require no locking devices of any kind and are easily removed when necessary. *Blade slots are machined true,* so that the assembled cutter cuts cleanly without any vibration to produce the smooth finishes so essential in aircraft work and elsewhere. To reduce inventory costs, blades are standardized and interchangeable with other designs of OK cutters. You have a choice of carbide, cast-alloy or high-speed steel blades as you prefer.

See for yourself why experienced shop men, at Liberty Products, in machine tool plants and elsewhere stock and use OK cutters exclusively. Write for new catalog "Modern Milling Cutters for Modern Milling Machines."

OK modern milling cutters for modern milling machines

THE O.K. TOOL COMPANY, WILTON, NEW HAMPSHIRE, Division Williams and Hussey Machine Company, Inc.



In the base starts the story of accuracy—deflections here are magnified in the column and the arm, and the whole machine loses the power to do the job correctly. Today new design bases again increase the accuracy of Bickford performance.

Many years of development are behind the base of a Cincinnati Bickford Super Service Radial Drill, and the many different types of base available all have the same basic deflection-free structure.

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Backlash

Speed Handling

I have received August 7 *AM* and read the article "Are We Riding the Brake in Machining Speeds?" and also the following article, "Machining Costs a Billion a Year Too Much." I should like to ask if it is possible for you to send reprints. The first one will be of interest because I deal with the same problems, and the second one because it gives an idea of what can be obtained by using the possibilities laid down in the first.

At the moment I do not have sufficient time to discuss the theoretical part of your article thoroughly, but I should like to make several comments on the practical aspects of it. You mention longer tool life and reduced power consumption as benefits from machining at higher speeds. Perhaps we can also take a step in another direction that will prove beneficial.

Handling time must also be cut down. This can be dealt with by machine-tool designers to suit the nature of the production. Tooling can be speeded up by practical arrangement of slides, tool post, or the like, and must be fitted to each special job. More generally, cycle time can be cut by using quick-acting tools, possibly operated electrically, pneumatically, or hydraulically. Feed and speed changes can be accelerated by practical arrangement of levers and handwheels, and the like, particularly by using a quick-acting mechanism such as the preoptive headstock.

I would like to amplify your statements regarding the effect of increasing speed on tool-tip temperature. Increasing the cutting speed from 100 to 600 sfpm causes a tool-tip temperature rise from 1030F to 1500F, as you say. But tool life must also be taken into consideration. It depends upon temperature setup and the wearing action of the chip sliding over the tool face (steel cutting), and these two factors are interdependent. The hardness number of cemented carbide will decrease at temperatures above about 1500 F, so the wearing action will accelerate. Tool life, therefore, is limited by losses in hardness combined with a cratering action, both due to the rise in temperature. In my opinion, the problem is to find the optimum point, considering both cutting speed and tool life. Most likely this selection must be held within narrow limits, which perhaps requires a driving mechanism with steplessly variable speed.

You are probably familiar with the special French thread-cutting lathe named Cri-Dan, with cam-operated tool slide, using cemented carbide tools and normal straight turning speeds. This might have been mentioned in your discussion on modern threading.

As to the drilling, I can add that a Swedish grinder maker recently announced a new method for grinding twist drills. Clearance angles are ground as in a turning tool, not following a tapered surface as usual. The company claims longer tool life, and a friend of mine who made a few tests confirms this.

Prof. K. V. Olsen
Machine Tool Laboratory
Royal Technical University
Copenhagen, Denmark

Wanted: Springback Tables

Years ago I used the value $0.33t$ for the distance from the inside of a brand to the neutral axis. But Kent's *Mechanical Engineer's Handbook*, (11 Ed.), says that "$x = 0.4t$" is close enough. And the excellent *Tool Engineers Handbook* gives $x = 0.5t$. When designing rollers for cold-roll forming, "good enough" is NOT good enough. We should have a table giving the value of x and the springback angle a when 90° bends are to be produced in materials of various kinds, thicknesses and hardnesses or tempers. Do you have a table of this kind?

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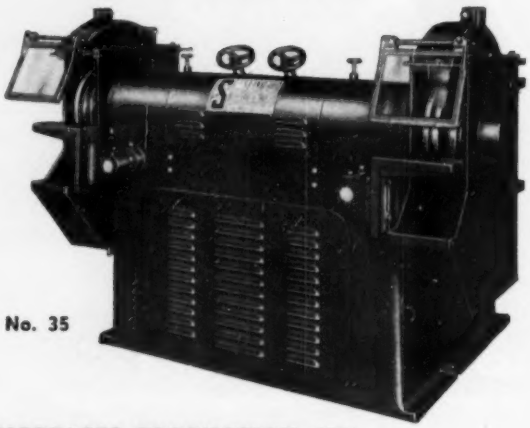

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The Standard No. 35 is a 2-in-1 machine—each operator is entirely independent of the other; one side may be stationary while the other wheel is operating; one side may be operated with a wheel differing in diameter to the other side, but each wheel operated at its correct and efficient peripheral speed.

SPEED CONTROL: Turn Hand Wheel to adjust *individual* wheel guard as wheel wears and simultaneously increase spindle speed in direct relation to worn wheel diameter, thus maintaining peripheral speed throughout wheel life. Safety interlock prevents overspeeding of grinding wheel.

NOTE: *No Tools or Wrenches are required--merely turn the Hand Wheel.*

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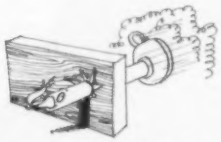
Harder With Velocity?

Your Special Report, "How to Stop that Waste in Machining" (*AM*, Aug. 7), is of great interest, particularly pertaining to the results with high-rake HSS and SHSS tools.

Just why these geometrically more fragile highrake tools perform as they do under the increased stresses and loads imposed by high speeds and feeds is most interesting, and it is clear that the increased cutting efficiency of the high rake angle results in less horsepower being put into the machine tool and consequently less heat required to be dissipated at the cutting edges of the tool.

However, is it not true that bodies in a state of high velocity acquire new *relative* physical characteristics? A homely illustration of this is the fact that a candle can be fired



through a wooden plank. By the same token, if two bodies of identical material and shape are traveling at high velocity, one traveling, say, twice as fast as the other, the higher speed body will, in effect upon anything with which they both collide, be much "harder" than the low-speed body. In fact, if the high-speed body were to overtake and collide with the low-speed body of identical substance, the high-speed body would penetrate or otherwise disintegrate the low-speed body.

This is further illustrated by the tendency of grinding wheels to act "softer" as their peripheral speed is reduced.

The writer entertains a theory that this phenomenon is a partial explanation of the function of high-rake, high-velocity metal-cutting tools. Such a tool, a milling cutter for example, would not function or stand up at conventional low cutting speeds, and it is the writer's thought that the comparatively fragile high-rake tools actually acquire new relative physical properties in a state of high cutting velocity.

The physical laws of energy involving mass and velocity can probably be applied to metal-cutting techniques involving high-velocity highrake tools.

Would be most pleased to have the reaction of you or any qualified commentator to this theory.

Name Withheld

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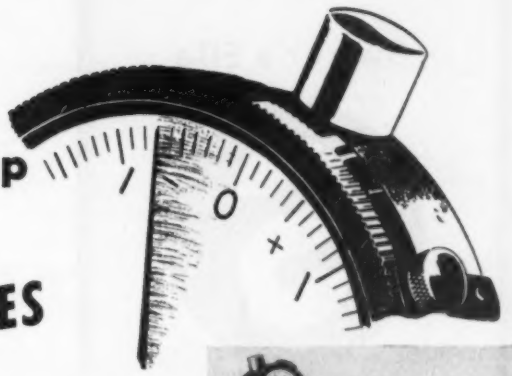

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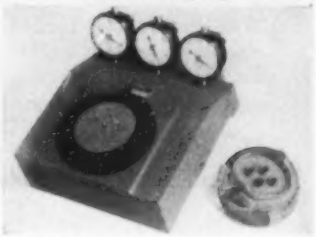

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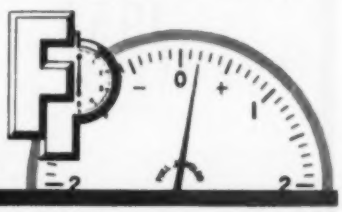

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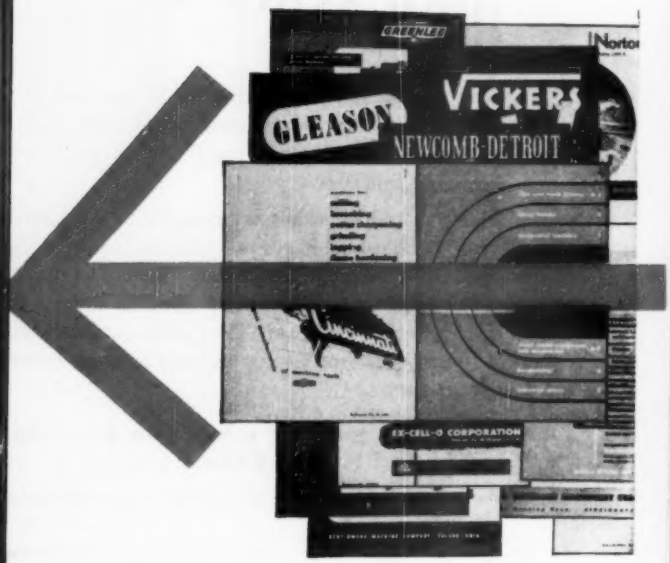

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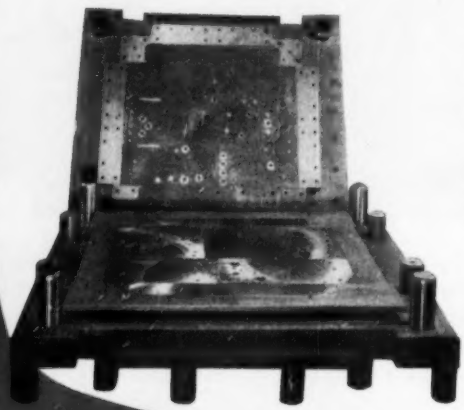

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SPOT NEWS of Metalworking

- **Large Pittsburgh steel maker with armor plate order will buy semi-finished steel** outside and roll it into cold-rolled sheets on its own sheet mill because its semi-finished tonnage will go into heavy plate.

- **General Motors is reported to have imported some 80,000 lb of Chinese coins** with large tin content. Electrolytic methods are being used to separate the tin. Some of the coins are of good quality bronze.

- **"Iron hands" are being installed on the lead presses** being erected in the new steel stamping plant of Chrysler Corp. in Detroit.

Broached internal gears for automatic transmissions are said to be satisfactory and less expensive than current method of machining which requires teeth to be shaved after cutting.

- **Washington does not plan to move inland any existing aircraft production facilities** on West Coast but any new facilities required will be located somewhere east of the Rockies. North American's acquisition of Curtiss-Wright plant at Columbus, Ohio, for expansion purposes has given West Coast interests the jitters.

- **Kaiser Shipbuilding is completing at its own expense the design of two new types** of cargo ships. Thus it will be in position to bid promptly if a shipbuilding program should open up. Kaiser is working with Maritime Commission on this project. Delay in shipbuilding in World War II was caused by length of time needed to develop suitable designs.

- **Days are back when manufacturers making steel products must furnish at least part** of steel tonnage to their parts suppliers in order to keep those suppliers operating. In August one independent motor car maker parceled out 600 tons of steel among its suppliers, including engine builders.

- **General Motors will manufacture hydromatic transmissions for Kaiser-Frazer cars.** About 25% of 1951 Kaisers will be thus equipped. An equal number of cars will have Borg-Warner overdrives. Kaiser-Frazer is now making 1200 cars a day and hopes to reach 1600 a day by December 1st.

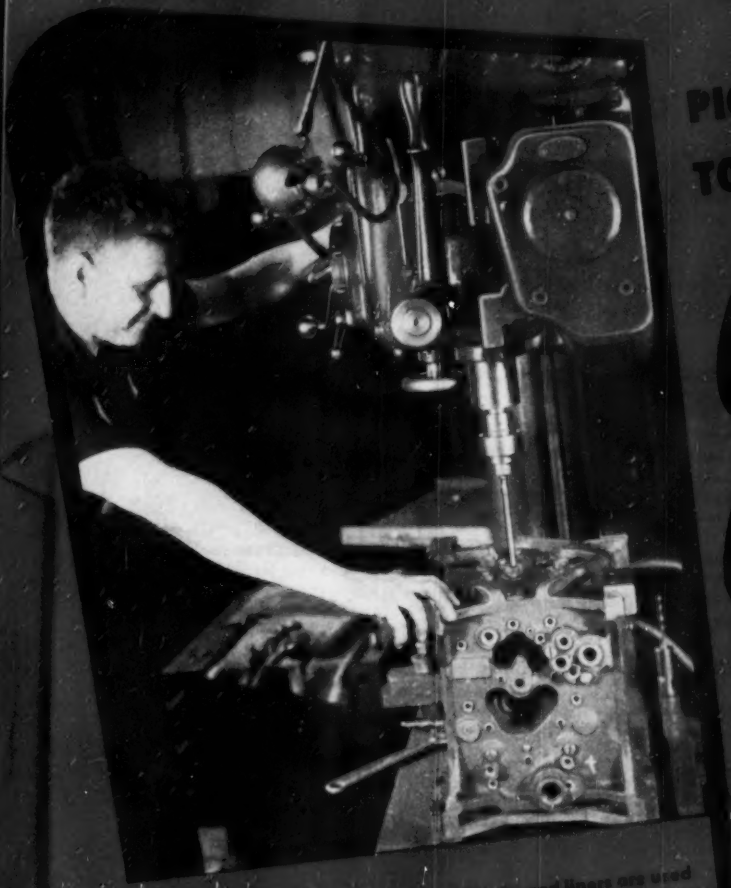
Large war materials factory may be established in Holland by Hispano-Suiza Factories. Negotiations are being carried on between the Netherlands government and Hispano-Suiza. The latter is prepared to invest 10-million guilders ($2,630,000) in the project.

- **Imported steel is now bringing premiums of $100 a ton or more over domestic steel prices.** Three months ago it was selling below domestic level.

- **International Association of Machinists expects to be back in the AFL** by end of the year. A settlement plan was approved by the AFL convention at Houston. IAM officers will urge its acceptance in a membership referendum.

- **As a result of lessons learned in Korea, look for:** large orders for the 3.5-in. bazooka to help arm Europe; U. S. to stand by its decision not to concentrate (as Russia is) on heavy tanks; design of a modern fighter-bomber for ground-support work and more kinds of tailor-made aircraft rockets for them to fire.

- **Allied High Commission has issued regulations for liquidation of six** great West German steel combines. These are: Vereinigte Steelworks, Friedrich Krupp Steelworks, Mannesmann Tube Works, Kloeckner Steelworks, Hoesch Steelworks, and Gutehoffnungshuette Steelworks, Oberhausen.



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FAST SHIPMENT FROM STOCK IN FOUR CITIES: In addition to a stock of over a quarter of a million bushings being renewed constantly in Detroit, standard bushings also are stocked for immediate shipment at Ex-Cell-O Corporation, 53 Park Place, New York; Machinery Sales Co., 2838 Leonis Blvd., Los Angeles, Calif., and Williams & Wilson, Ltd., 11 Front St. E., Toronto, Ontario, Canada.

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This Ex-Cell-O catalog, Bulletin 35371, will help you pick the right bushing to fit the job. A copy will be sent to you on request without obligation.

Washington

Again as in World War II, mobilization controls are coming piecemeal. It will be months before the final pattern is set.

Administration's new priorities set-up — National Production Authority Regulation II—looks like a lot more than it really is.

It does give the businessman a formal excuse for back-ordering his civilian customers, and replaces the unofficial letters and telegrams used by the armed services since Korea for expediting military orders. (See news story, p182.)

Mobilization Planners figure Reg. II—with spotty exceptions—is good for several months at least, maybe even a year.

Some of the exceptions aren't far off. Copper in particular will go under strict controls very shortly. Aluminum is expected to follow closely; then others, including probably some components.

Meanwhile, in the coming weeks, look for further delegation of "rating" authority by NPA on transportation, metals, petroleum, and probably farm machinery. Odds are they'll come in that order.

• • •

Enough industrial capacity to beat us. That seems to be the prime objective of Stalin's 10-year steel plan.

Kremlin's 1960 annual production goal is 60-million tons instead of today's 25-million tons.

Present Russian steel consumption pattern provides the answer: Over 50% is for expansion of basic war industries, such as steel itself. Some 8-million tons is used by heavy machinery producers—hiding about 3-million for end-use war goods. Third biggest chunk goes into Russia's vulnerable transportation network, mostly railroads. Farm machinery gets 1-million tons; light industries, including all consumer goods, about 500,000 tons.

• • •

Maritime Board's decision to go ahead with prototype design and construction of a 20-knot (it will be faster than that) 12,000-ton cargo ship is just a prelude to the over-all plan to build 200 such ships.

Meanwhile, Navy's got the OK on an active fleet of 1000 ships. By 1952 the Admirals hope to have 22 carriers, and three battleships manned and afloat. Between now and June 30 they plan to take 296 ships out of reserve including one large carrier, two escort carriers, the battleship *New Jersey*, 32 destroyers, three destroyer escorts, five submarines, numerous smaller ships.

Also, construction of a super-carrier (they won't call it that) next year is virtually assured.

Don't be surprised if high temperature, corrosion-resistant steels containing columbium and cobalt disappear from the civilian market.

Military's new jet engine program will take everything that's available—and then some.

• • •

New U.S. weapons are proving themselves in Korea. The 3.5-in. bazooka is sure death to Soviet armor. Navy's 6.5-in. aerial rocket (with a shaped charge warhead) is air-support's best anti-tank weapon.

Ground support aircraft—both jets and piston jobs—did a good job. High-flying, high-speed jets weren't made for it, however: they couldn't stay long enough on station; flutter resulting from necessary use of dive brakes in low altitude runs made them poor firing platforms.

Also, Air Force interceptor pilots, faced with close-in ground support work for the first time, made a few fatal mistakes during their initial on-the-job-training period.

Close-support Marine fighters proved the worth of pre-combat training. Their rockets scored one direct hit for every six fired against an aircraft operation average of about 1-to-18, a good score in itself.

Navy carriers proved invaluable in supplying combat air cover. And shore bombardment by capital ships is still an operational must.

• • •

Real tightness in the labor supply isn't expected before next spring, but by then you'll feel the pinch. By then defense production will be really rolling; more men and women will be in uniform.

Government manpower experts think now is the time to act, if critical manpower shortages in various skills are to be held to a minimum.

That's why Labor Secretary Maurice J. Tobin has already set up an Office of Defense Manpower in his Dept.

And, why Leon Keyserling, chairman, President's Council of Economic Advisors has recommended workers put in more hours per week to keep the strain on the economy to a minimum.

U. S. Bureau of Employment Security, meanwhile, claims that if same proportion of population makes themselves available for work as did in World War II, we can raise our work force by 5,600,000 to a total of 69,100,000.

• • •

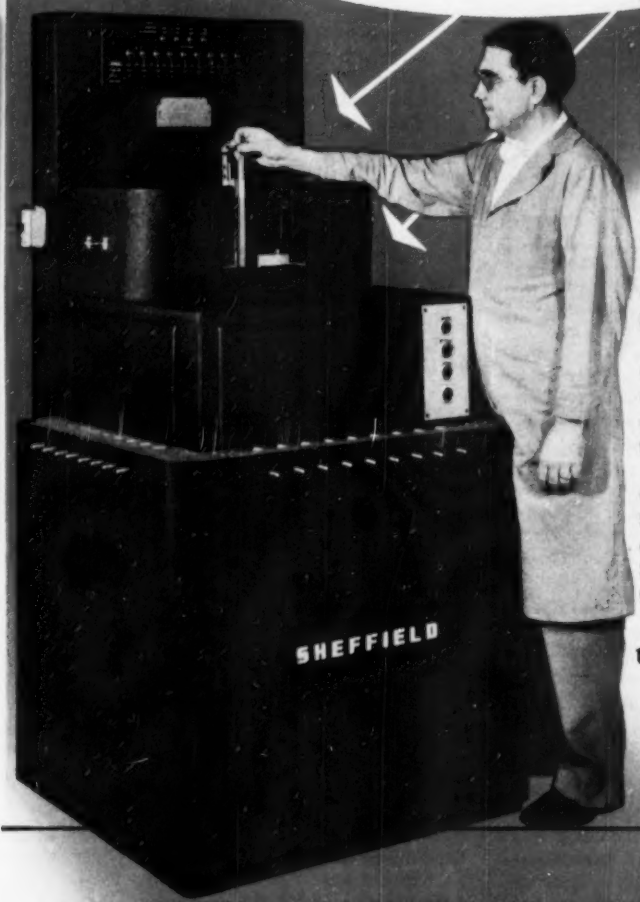
Some signs that the labor supply is tightening up:

September unemployment was 2,341,000—A 21 month low.

Last month's 61,226,000 employment figure set a new record for September—2,000,000 over 1949.

"E" areas of heavy unemployment dropped from 14 in July to 11 in August, from 43 in January.

$25,000
Saved on inspection in 24 months



This Sheffield machine gages and segregates refrigerator valve plates into 28 classifications—2,000 parts an hour. It has already paid for itself and is now saving a little more than $1,000 a month over the previous hand gaging method

The job is exacting because these valve plates have a highly lapped finish. They can be completely ruined by even the slightest scratch, and that happened frequently when they were gaged by hand.

The parts are loaded into the machine and a button pressed. The machine sorts and stacks them in individual chutes according to size, without marring their finish.

If you inspect mass-produced parts, why not look into the possibilities of Sheffield gaging and segregating machines. You will gain the benefit of Sheffield's many years of experience in this field. *Write for engineering data.*

5480

the *Sheffield* corporation

SHEFFIELD

Dayton 1, Ohio, U. S. A.

GAGES • MEASURING INSTRUMENTS • MACHINE TOOLS • CONTRACT SERVICES • THREADING TOOLS

Detroit

General Motors has cancelled its January automobile show in New York, that brilliant display which filled the Waldorf-Astoria in 1948 and 1949 with new products and notable personages. The reasons: fear that such an extravaganza might look bad in the midst of a war economy; fear, too, that materials might be short enough by then that production would be importantly impeded—putting a halter on sales expansion created by the show.

• • •

Materials shortages were at the root of cancellation by the Trailer Coach Manufacturing Assn. of its annual exposition in Cleveland in November. The trailer makers are booked well ahead now. Any materials allocations would intensify problems of filling orders booked at the show.

Nevertheless, automobile industry bigwigs are talking once more about a National Automobile Show. The thinking now is that they might stage a national exposition coincident with the Anniversary Jubilee to be celebrated by Detroit next summer. Under this planning, a show building, would be erected in Detroit.

• • •

Prices keep going up. Every 1951 automobile line introduced thus far has been at higher prices than comparable 1950s—Packard, Nash, Hudson, Willys-Overland. And Kaiser-Frazer raised levels on its cars introduced early in the summer. The Henry J (the 2-door lowest price model of Kaiser-Frazer) was tagged $1299 factory delivered on the 4-cylinder job—approximately $100 higher than planning called for when tooling was started last spring.

• • •

Write your own ticket on how much arms production is going to hurt civilian production next year. General Motors still is figuring publicly in terms of about 10 percent, is expecting to run during the first 1951 quarter at the rate of the fourth 1950 quarter.

From Kaiser-Frazer, however, comes a dissenting note. K-F thinks that production might be cut back as much as 15 percent or 20 percent due to materials and manpower shortages next year.

Washington rumors, meanwhile, are that automobiles will be cut back 12 percent before long, the base being the first half of 1950. That's more conversation than fact right now. But auto people feel Washington latrine talk can often turn into action—quickly.

Shortages of steel are now being intensified by increasing tightness in pig iron. Other tight spots continue tighter—chrome, copper, lead, aluminum.

• • •

Ford has broken up its erstwhile General Manufacturing Div., creating instead a manufacturing group consisting of 6 divisions—aircraft engines, Chicago; automatic transmissions, Cincinnati; Canton Forge, Canton, Ohio; Highland Park (trucks, tractors); Mound Road (now spare parts, reportedly axles later on); and tractor and industrial engines.

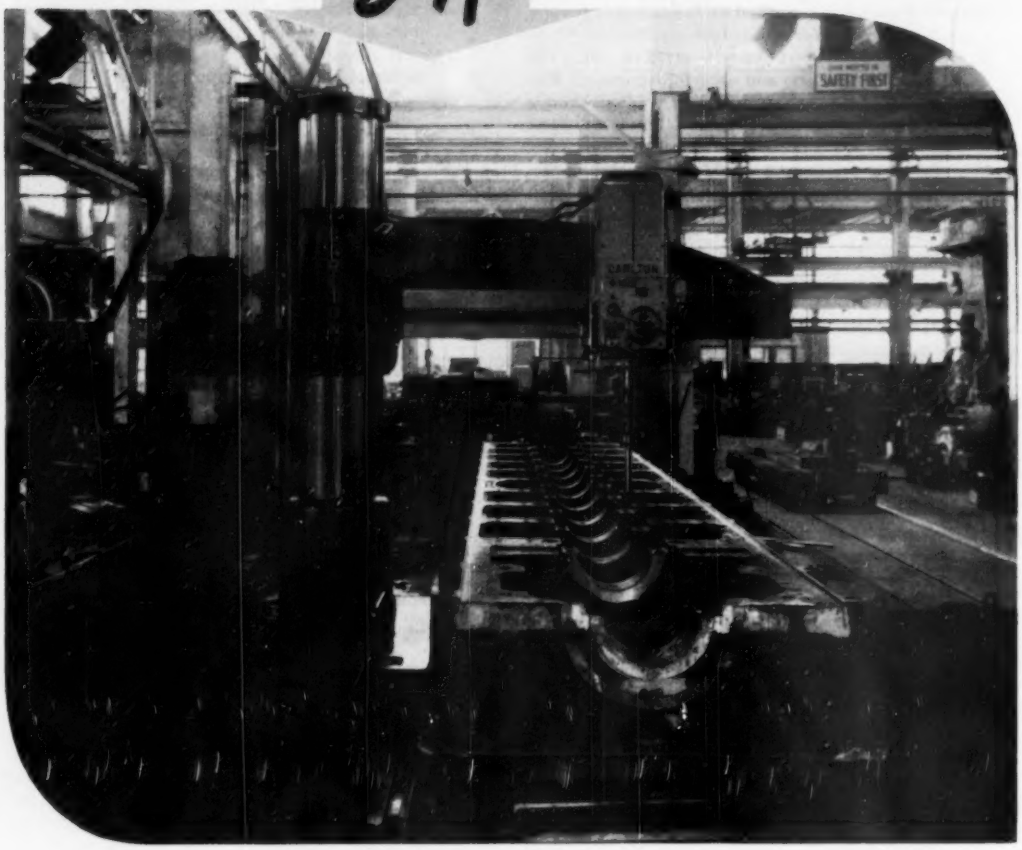
Under the new setup each of these divisions will handle its own purchasing of machinery, tools, equipment, materials.

• • •

Fisher's new manufacturing plant at Pittsburgh is now operating, furnishing components to 21 G. M. assembly plants. This seventh fabrication factory of Fisher has 651,800 sq. ft. of manufacturing space for building of stamping dies and tools and fabricating sheet metal parts. There are 79 major presses, capacity from 600,000 to 2,200,000 lb, 90 smaller ones of 64,000 to 260,000 lb capacity. The metal shop includes 85 production welding machines; the tool room has 90 machines; about 900 dies and fixtures are assigned to the plant.

THE HENRY J, Kaiser-Frazer's less-expensive auto, features high-compression "Supersonic" L-head engine, with brake hp of 68 at 4000 rpm for 4-cylinder model, 80 at 3800 rpm for 6-cylinder car. Rear seat back folds forward as part of trunk floor to give extra cargo area. Rear trunk opening is eliminated. Overall length is 174¼ in.; overall width, 70 in. Height is 59⅝ in.

CARLTON 5-A RADIAL DRILL



➡ speeds Diesel Engine Production

This husky Carlton 5-A Radial drill, with track-type base, quickly drills and bores bulky jobs that extend over large areas like this 9-cylinder 3600-hp Nordberg diesel engine bedplate. This arrangement offers peak efficiency since one machine can handle the entire job.

The Carlton 5-A is also available with a stationary base and offers the maximum in modern control plus easy, fast, cost-cutting operation. For the "hole" story on Carlton radials, send today for descriptive bulletins.

THE CARLTON MACHINE TOOL CO.

THE CARLTON MACHINE TOOL CO.
CINCINNATI 25, OHIO

New Tooling

There was little letdown in machine tool orders in September compared with August. For the first time, defense business has appeared impressively among bookings of certain builders. Most of it is for ordnance.

New Cadillac tank arsenal at Cleveland has been buying heavily for February delivery. It still has a long list of machines to purchase. For sake of speedy deliveries, it is taking some used machines.

Ordnance contracts in Philadelphia district are resulting in machine tool orders. Not much business has been placed yet by aircraft people.

• • •

Small shops on west coast are reequipping in hope of getting subcontracts when plane production is expanded. Many machines are being acquired on time-purchased plans.

Prospective machine tool orders from plane industry are enormous. Example: Ford will be in market for huge number of machines for its plane engine factory at Chicago (former Dodge-Chicago plant). It will build Pratt & Whitney engines.

Machine tool bookings continue predominantly for non-defense purposes. Automotive retooling needs have filled up many of the shops of builders of "specials."

Fourth quarter looks extremely good, as defense orders begin to pour in. First quarter of '51 also should bring high level of machine orders.

Mechanical press builders are just as busy as machine tool industry, or perhaps busier. Automobile makers' requirements are backbone of the current rush. Defense orders are negligible.

• • •

Tax law permitting defense contractors to write off new plant and equipment expenditures in five years will have no meaning until authority is named having power of certification for individual applications.

• • •

What machine tool builders need to "get off the hot seat" with important civilian customers is a formal priorities order giving preference to defense business. No such order is in the works at present.

Steel and electric controls and motors are chief materials worry of machine tool industry. Steel mills want to adhere to historic pattern—how much steel you took in 1949, a poor year for machine tool production. They are supported by newly-created Iron & Steel Branch of NPA headed by Frank McCue.

• • •

British government has decreed that after October 6 its machine tool builders must secure special permits to export to other than U.S., Canada and British Commonwealth members. This may end shipments to Russia.

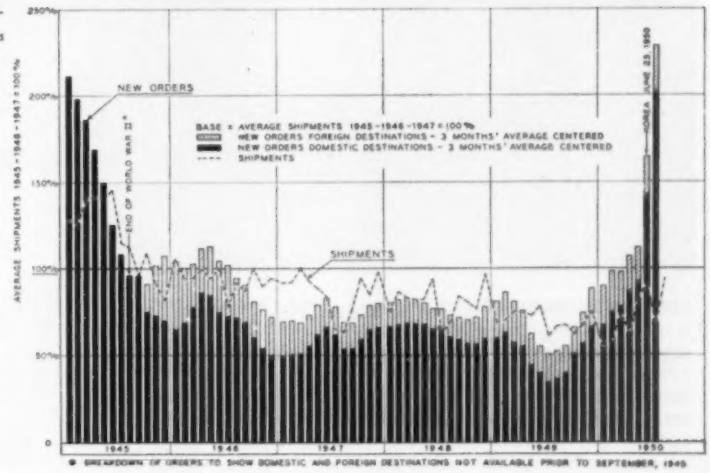
Machine tools are believed to be on secret list of strategic materials that Department of Commerce says cannot be exported after Dec. 31 to any ECA country which has not stopped by then shipping strategic materials behind Iron Curtain. Commerce refuses to divulge list.

FOREIGN ORDERS HELPED PUSH MACHINE TOOL INDEX TO POSTWAR PEAK

(Estimated orders and shipments—metal cutting types only)

	New Orders (3 mo. Avg)	Foreign Orders (3 mo. Avg)	Shipments (Total)
1945			
Jan.	211.8	(Not	130.0
June	124.1	Avail-	146.0
Sept.	96.1	able)	96.3
Dec.	108.9	37.7	81.7
1946			
Mar.	103.2	25.3	95.2
June	105.3	29.7	99.8
Sept.	90.5	20.9	87.5
Dec.	72.5	22.4	95.2
1947			
Mar.	69.3	18.2	100.4
June	83.0	16.7	84.1
Sept.	68.9	15.1	77.0
Dec.	79.9	13.4	98.4
1948			
Mar.	83.3	14.3	83.6
June	77.0	12.2	94.4
Sept.	71.4	13.1	84.7
Dec.	78.6	18.7	96.9
1949			
Mar.	81.5	24.0	75.8
June	55.1	15.2	79.0
Sept.	55.3	14.4	67.6
Dec.	88.8	22.0	75.7
1950			
Mar.	98.5	20.4	75.3
June	164.5	21.2	91.9
Aug.	p 307.3	p 34.1	p 93.7

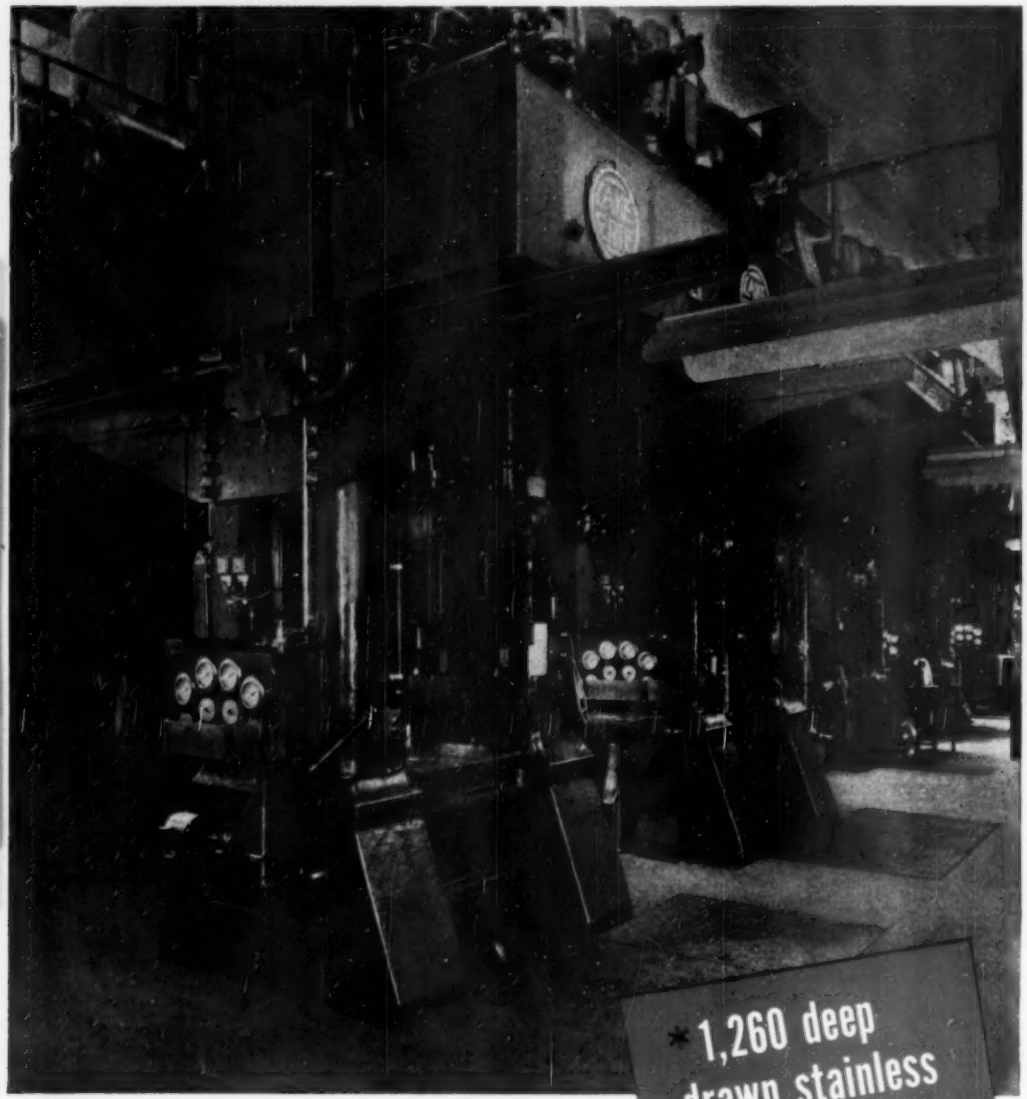
Source: NMTBA p—Preliminary



* BREAKDOWN OF ORDERS TO SHOW DOMESTIC AND FOREIGN DESTINATIONS NOT AVAILABLE PRIOR TO SEPTEMBER, 1945

HYDRAULIC PRESSES WITH THE

HIGHEST SPEEDS* IN



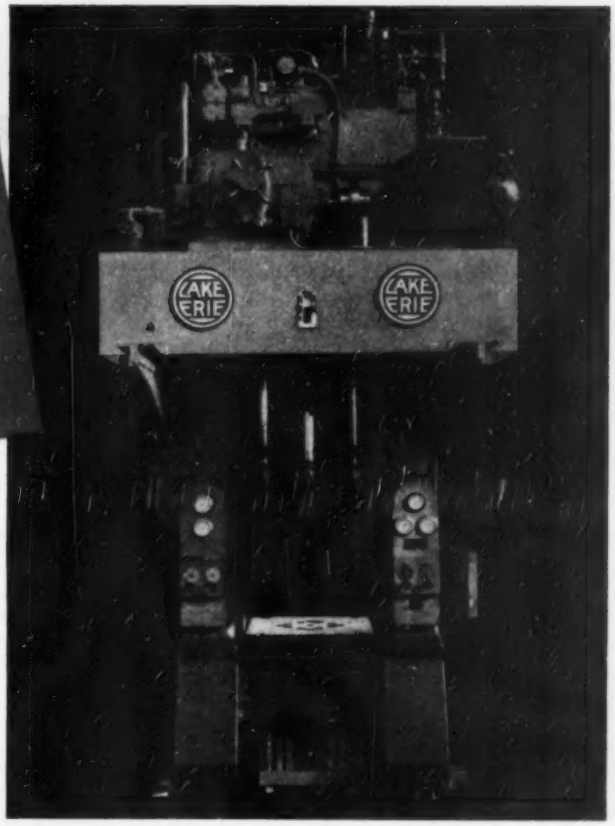
*** 1,260 deep drawn stainless steel pieces per press per hour**

300-TON SUPER-SPEED double action Lake Erie hydraulic presses. A battery of six of these units is shown in the plant of a leading automotive equipment manufacturer. Press has 150-ton main ram, 150-ton clamp slide and 75-ton die cushion. Bed area is 40″ x 40″, draw stroke 30″ and clamping stroke 18″. With 275 hp, press produces 2000″/min. approach and return, and 460″/min. pressing to capacity. Available in a wide-range of tonnages, bed sizes, daylight openings and strokes. Descriptive literature furnished on request.

HISTORY ARE SLASHING PRODUCTION COSTS

FOR AUTOMOTIVE PARTS PRODUCER

Lake Erie designs the fastest double action hydraulic presses ever built. Leading automotive parts manufacturer replaces complete battery of outmoded presses...production soars... costs are slashed. Press dependability proved on double shift operation.



Once again Lake Erie's engineers have scored a triumph for production efficiency. Designing for speeds never before achieved, a new line of presses has been created. They are not only vastly faster than any heretofore available but have demonstrated their superior dependability in actual day-in and day-out production. If your production calls for large runs of deep drawn pieces, these super-speed presses present an opportunity to save thousands of dollars in production time. Write or phone for complete details. No obligation.

LAKE ERIE
ENGINEERING CORP.
BUFFALO, N.Y. U.S.A.

LAKE ERIE ®

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MANUFACTURERS OF
HYDRAULIC PRESSES AND SPECIAL MACHINERY

General Offices and Plant:

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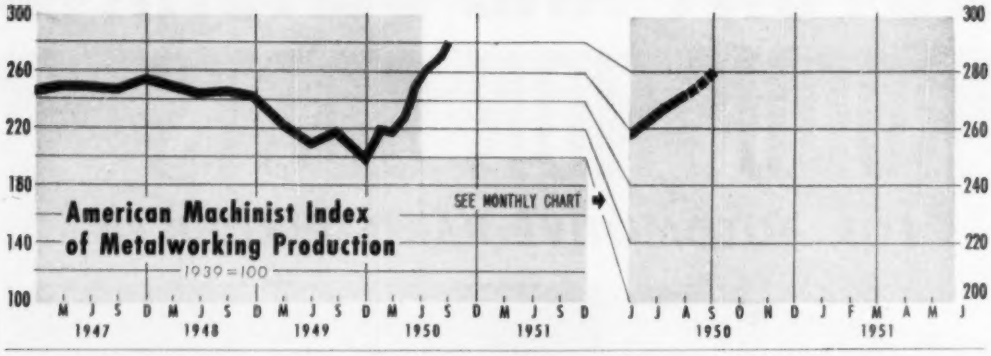
DISTRICT OFFICES IN NEW YORK, CHICAGO and DETROIT

Representatives in Other Principal Cities in the United States and Foreign Countries

Manufactured in Canada by: Canada Iron Foundries Limited

Leading manufacturer of hydraulic presses—all sizes and types Metal Working...Plastic Molding...Forging...Metal Extrusion...Processing...Rubber Vulcanizing...Stereotype Molding Plywood...Wallboard...Briquetting...Baling...Special Purpose.

Gaging Metalworking



Availability of Steel Will Rule Production

September was a tremendous month for new orders in almost all metalworking lines. October promises to duplicate September.

Meanwhile production is being stepped up to the full limit of available steel and copper. Manpower shortages also are acting as a brake in holding back expansion of output.

Defense business, both ordnance and aircraft, is beginning to break. But it still is relatively small and calls for large amount of tooling before production really gets going.

• • •

Steel headaches are plaguing users. One midwest consumer has bought 5000 tons of hot-rolled strip in Germany, paying premium of $20 a ton, and fair tonnage of bar stock in England. Another user has received initial shipments on order for 12,000 tons of steel placed in England.

NPA's new Iron & Steel Branch, which will establish steel priorities soon, is thinking in these terms: gradually growing ratio of steel, probably up to maximum of 30%, for defense work, with civilian allocations based on 1949 usage.

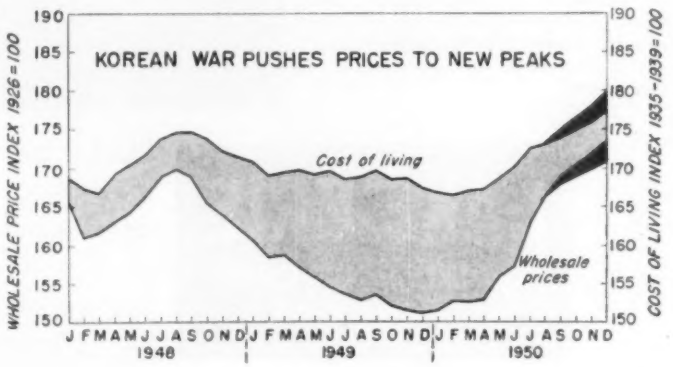
Certain important steel users have had their tonnage quotas for fourth quarter cut 20% below allocations in second and third quarters.

They intend, however, to continue operations at current peak rate the remainder of the year, drawing on their dwindling inventories of steel to fill their requirements. Result is likely to be sharp cut in output, perhaps up to 25%, early in 1951.

Nickel and aluminum are causing about as much worry as steel and copper. Demand for aluminum pig and ingot has spread; at the same time, amount available this month from a leading producer has been cut 40% because of labor trouble.

Tightness of metal supply is resulting in substitutions similar to 1941 situation. Shortness of copper and nickel are forcing substitutions of stainless steel for plated trim for auto bodies.

	Cost of Living (1935-39 = 100)	Wholesale Prices (1926 = 100)
1948 Jan.	168.8	165.9
Apr.	169.3	163.0
July	173.7	168.8
Oct.	173.6	165.4
1949 Jan.	170.9	160.7
Apr.	169.7	157.1
July	168.5	153.6
Oct.	168.5	153.5
1950 Jan.	166.9	151.5
Feb.	166.5	152.7
Mar.	167.0	152.7
Apr.	167.3	152.9
May	168.6	155.9
June	170.2	157.3
July	172.5	162.9
Aug.	173.0	166.3
Sept.	174.0-175.0	168.0-169.0
Oct.	175.0-176.5	169.0-170.5
Nov.	175.0-178.0	170.0-172.0
Dec.	177.5-180.0	171.0-173.5



INDEX

	SEPT. '50	AUG. '50(p)	JULY '50(r)	SEPT. '49
	280*	274	266	222
Machinery		249	244	199
Electrical Manufacturing		321	303	229
Automobiles, Trucks		260	256	210
Transportation Equipment		275	250	238
Other Metalworking		290	286	235

AMERICAN MACHINIST'S INDEX OF METALWORKING PRODUCTION is based on manhours worked in the five components above.

*Estimated (p) Preliminary (r) Revised

Second shifts and sometimes third shifts are being put on increasingly. Overtime, including a growing number of companies working five and six days a week, is spreading.

• • •

Auto manufacturers are predicting high auto output in the first quarter of 1951. If this industry feels the pinch, it will be due to the shortage of copper. Stockpiling, allocations and reduced imports have cut the normal supply.

About the time you read this, automobile assemblies since January 1 will have passed the highest mark ever set in any calendar year—6,549,179 units in 1949. From here forward through December, almost 2 million units will be turned out. It may be a long time before the automobile people enjoy another 8-million-car year.

• • •

Freight car operations are shooting skyward as orders pile up and NPA throws its influence behind steel allocations to car builders. Objective: to lift freight car assemblies to 10,000 a month. Hope is to maintain that level, once reached, throughout next year or longer.

• • •

Tool and die shop activities reflect the immense amount of tooling and retooling now going on. Most contract shops are over their ears in work. Business is two or three times the total of a year ago. Tool and die makers are becoming scarce.

Industrial production for September is now expected to reach 212% of the 1935-39 average. Government economists expect it to top 230 by mid-1951.

• • •

Pirating of labor has made its first appearance in the Cleveland area, with recruiting of skilled labor being done mostly in bars after working hours. Companies known to be having difficulty in getting raw material—that causes frequent shut downs—are the primary targets.

• • •

Household appliance output will be down 20% in 1951 at General Electric. But full production is assured the remainder of this year. GE thinks greater sales effort will be necessary next year, despite decline in available supply. Reasons: (1) end of scare buying, (2) tighter credit controls, (3) higher income taxes. GE's slant on situation is typical of entire appliance industry.

• • •

Farm equipment demand has held up amazingly. Scare buying, however, has subsided. Order books of all producers are loaded; and production is suffering badly because of International Harvester and Deere strikes.

• • •

Construction machinery sales attained a new peak for the year in September, say several prominent companies. Current high volume is likely to continue.

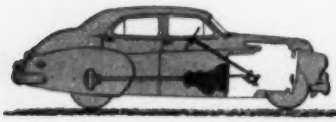
WEEKLY BUSINESS INDICATORS

	Latest Week	Preceding Week	Year Ago
Business Week index of activity (1923-1925 = 100)*	223.5	222.7	178.8
Steel ingot operations (% of capacity)	101.2	100.7	8.2
Electric power output (million kilowatt-hours)	6,503	6,457	5,521
Production of automobiles and trucks	185,529	188,451	151,593
Engineering construction awards. (Eng. News-Record; millions)	$288.0	$244.8	$152.4

MONTHLY BUSINESS INDICATORS

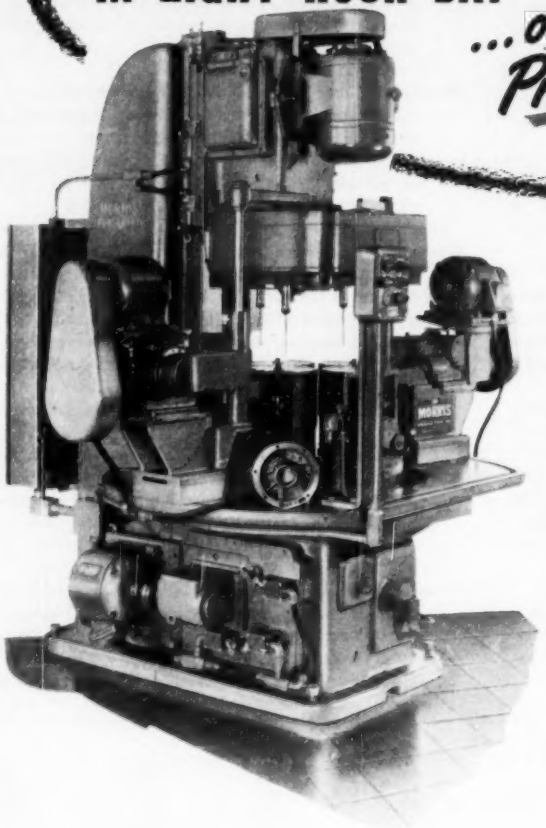
	Latest Month	Preceding Month	Year Ago
Refrigerators, domestic sales (thousands of units)	496	491	308
Vacuum cleaners sales (thousands of units)	341	280	220
Washers sales (thousands of units)	381	282	323
Household electric ranges (thousands of units)	132	131	66
Television receivers production (thousands of units)	702	330	186
Radio receivers A.M. and A.M.-F.M., production (thousands of units)	1,203	725	623
Gear sales index (1935-1939 = 100)	617.4	410.7	262.0
Foundry equipment new orders index (shipments 1937-39 = 100)	693.6	401.8	166.6

*Seasonally adjusted.



Automobile manufacturer speeds production

600 AUTOMATIC TRANSMISSION COLLECTOR RINGS DRILLED AND REAMED IN EIGHT HOUR DAY ...on MORRIS Production Machines



The drilling and reaming of Collector Rings presented a bottle-neck to increased production of automatic transmissions for a prominent automobile manufacturer. Morris engineers were asked to produce a machine which would provide the production required at the desired efficiency.

The solution consisted of the Morris Vertical Four Station Automatic Indexing Machine illustrated. This production machine has a 24 inch table; one 3-spindle hydraulic vertical head and two single spindle rack fed auxiliary side heads with four mounted hand clamp fixtures. Seventy-five Collector rings are drilled and reamed per hour at eighty per cent efficiency.

If your work requires drilling, reaming, tapping or similar operations, on a production basis, Morris Machine Tool Company can design, develop and build a production machine to meet your specific job requirements.

THE MORRIS MACHINE TOOL COMPANY

"A better product at less cost— with MORRIS ENGINEERED PRODUCTION"

Builders of MOR-SPEED Line

933 HARRIET STREET CINCINNATI 3, OHIO

American Machinist

MAGAZINE OF METALWORKING PRODUCTION ★ ESTABLISHED 1877

What Are You Going To Do For Men?

As your manpower problem becomes more acute, what are you going to do for men?

To begin with, we haven't the slack to take up that we had in 1940, when the last defense program got going. Industrial production then was on the low side. Now it is booming. Operations today are two-and-a-half times the prewar rate.

Fewer people are unemployed, relative to the total available work force, than ever before. There are no reserves of skilled men to draw on. Yet defense production thus far is microscopic.

UNFORTUNATELY, the situation promises to get worse rather than better. Thousands of men will be taken into the armed services from industry as we build up our Army, Navy, and Air Force. And the teenage youngsters coming along comprise the smallest reservoir of military manpower in years. They are the product of the depression years, when the birthrate was low.

What's more, men in large numbers will be needed for our armament plants. Our defense requirements will take precedence over everything else.

The manpower problem thus confronting Metalworking calls for resourcefulness and ingenuity if a satisfactory solution is to be reached.

MANAGEMENT has the responsibility, under the circumstances, of trying harder than ever before to get the greatest possible productivity per manhour from its employees. To that end, we suggest the following program:

1. Find out how busy machines are. If possible, keep them busier. They are of value to you only as long as they are cutting metal. The operators of those machines are of value only as long as they are at work.

2. See that your machines are properly tooled for the job. Good tooling will increase output. Greater output spells higher productivity per manhour.

3. Explore the possibilities of higher machining speeds. High speeds are being used successfully in a constantly growing list of shops.

4. Bring the worker's tools and materials to him instead of wasting his time by forcing him to go away from his regular station to get them. Use mechanical means to transport the tools and materials.

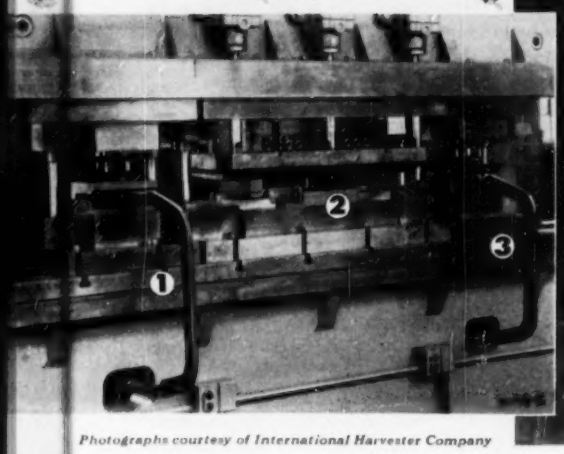
5. Substitute mechanical muscles for human muscles in every conceivable spot in your plant. Load and unload machines mechanically wherever possible.

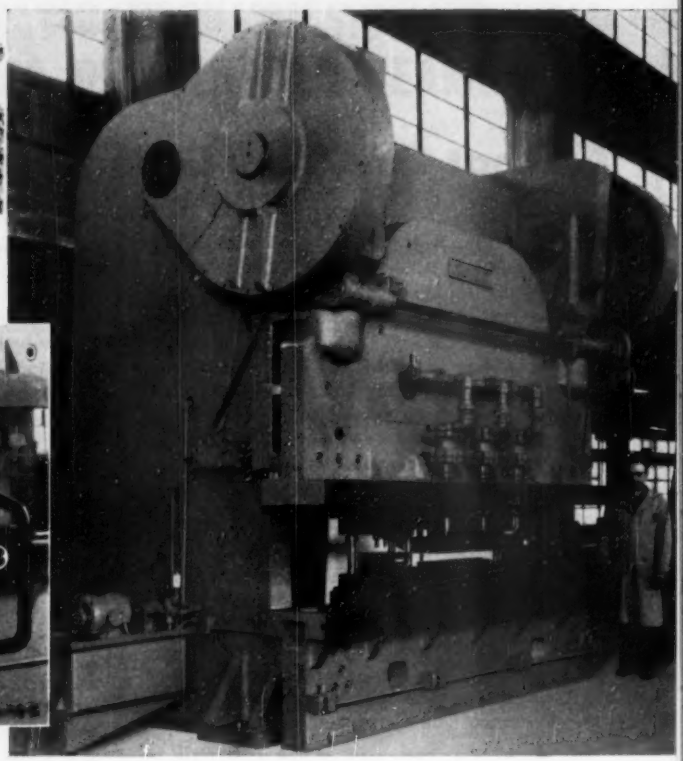
6. Take advantage of the new, postwar-designed machines now at your disposal. Replace your old, high-cost, labor-consuming equipment in favor of new, low-cost labor-saving machines.

WE MAKE NO CLAIM that this six-point program will solve your manpower problems. But if you should explore carefully the higher productivity that such a program will yield, your manpower situation may not be as acute as it otherwise would be.

Burnham Finney

COSTS CUT FROM $25.26 to $2.24





Photographs courtesy of International Harvester Company

Simultaneously punching **3** draw bars on self-contained interchangeable die sets.

1000-Ton Cincinnati All-Steel Press Brake punching 1045 H.R. Steel tractor draw bars.

The cost of two machining operations on draw bars for International Farmall Tractors was reduced from $25.26 per hundred to $2.24, by changing the method to punching on a Cincinnati Press Brake.

This Cincinnati 500 series All-Steel Press Brake is punching 13 holes and 2 slots in 5/8" SAE 1045 H.R. steel draw bars. Hydraulic strippers clamp draw bars flat and strip punches effectively. High visibility of work is obtained. Two types of bars are produced and interchangeable dies are engineered for easy, quick changeover.

Investigate! Your costs may be reduced by using a versatile Cincinnati All-Steel Press Brake.

Write for the comprehensive and suggestive catalog B2A on Cincinnati Press Brakes.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO U.S.A.

SHAPERS · SHEARS · BRAKES

CINCINNATI

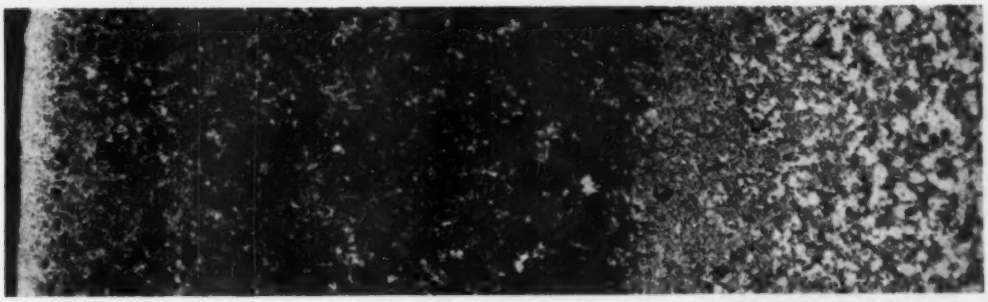


Fig. 1 .. Effective case depth extends from the left through the light, fine-grained zone past midpoint and to first occurrence of solid-white grains of ferrite. The gradation zone proceeds from latter point to uniform occurrence and size of ferrite grains

GOOD CARBURIZING PRACTICE

I . . The Carburizing Process and Pack Carburizing Compounds

High hardness and resistance to wear are required for many parts — gears, cams, splined shafts, rollers, balls, links, cutters, tools, machine components. To achieve these properties, one casehardening method — carburizing — is widely practiced in a great many plants, large and small. There is a need for information on how carburizing is carried out by several methods in an efficient manner. Mr. Frischman, who has had years of practical experience, will give you up-to-date information on carburizing in this and several succeeding instalments

BY T. A. FRISCHMAN, Chief Metallurgist, Axle Division
EATON MANUFACTURING CO.

CARBURIZING is a major heat-treating process. It imparts many desirable properties to carbon and alloy steels of low carbon content, and to a lesser extent to steels of medium carbon content.

Basically, carburizing is a case-hardening procedure whereby carbon is added to steel from the surface inward to a specified depth. The carbon content in the affected zone must be sufficiently high to impart the desired wear resistance, hardness and strength after a subsequent hardening heat treatment. The underlying metal retains its original toughness after treatment.

The layer of higher carbon enrichment is termed the "case," the original or underlying material the "core" and the blend zone in between is known as the gradation zone.

These zones are shown by Fig. 1, which is a photomicrograph of a chromium - nickel molybdenum steel slowly cooled from the carburizing temperature. Here the "effective case" is the portion extending from the surface through the underlying carbide network and dark pearlitic zone and into the light fine-grained zone to the point where the first grains of ferrite (solid white) are encountered. The gradation, or transition, zone runs from this point to the structure showing uniformity in size and occurrence of ferrite grains. Some persons consider even more of the fine-grained zone (light-gray) as part of the gradation zone. Progressive diminution of carbon from surface to core is termed the "carbon gradient."

Microconstituents formed by slow cooling of the carburized steel are: (1) carbide, (2) pearlite, and (3) ferrite. These microstructures of the slowly cooled case and core will appear differently after the hardening heat-treatment. Development of the improved physical properties desired is only obtained by quenching the carburized case from prescribed temperature above the transformation range of the steel. When this is done the carbon-enriched case becomes hard and wear resistant.

The mechanism of carbon enrichment is complex. First, and foremost, carbon must be made to enter the iron or steel, but carbon

Fig. 2 .. When carburized steel is slowly cooled, a lamellar pearlite and ferrite microstructure is produced. Alternate dark plates are carbide; white areas are ferrite. Magnification: 1000 X. At lower magnifications, carbide plates shadow intervening layers of ferrite, and pearlite appears dark all over

is not usually soluble in steel in the same proportions at all temperatures. This situation arises because iron is allotropic; that is, it can exist in more than one form. These forms change with temperature. They are considered to be: (1) alpha, (2) beta (controversial), (3) gamma, (4) delta and (5) liquid, the latter two being of no concern where carburizing is involved. In the alpha form, iron can dissolve only about 0.04% carbon. In the gamma form, iron can dissolve up to 1.7% carbon. Hence, the iron of the steel is put into the gamma form when carburizing is performed.

The prevailing concept of carburizing reactions is that carbon dissolves in gamma iron at the surface from a gas such as carbon monoxide, methane, propane, oil vapor or other such medium. At customary carburizing temperatures, iron in the gamma form is capable of dissolving carbon and alloying elements to form a solid solution known as austenite. As the operation proceeds, carbon continues to be added to the surface, and migrates inward at a rate dependent upon such factors as diffusion coefficient, temperature and the carbon potential of the carburizing medium.

Up to 1.7% carbon can be dissolved in the austenite but this is seldom done in industrial practice. Maximum hardness is obtained when carbon content is about 0.80% and decreases progressively somewhat beyond 0.90%. To be on the safe side, the aim is generally to obtain 0.85% to 1.20% carbon. Higher carbon content is usually chosen only for special applications, and requires processing precautions not otherwise employed.

Temperature Affects It

Because solubility of carbon in steel increases with temperature above the transformation range, it follows that the higher the carburizing temperature, the higher will be the resultant carbon content. Also, as solubility increases, so does the rate of carbon diffusion. But a point is reached where the speed is limited by other factors. Too high a carburizing temperature is undesirable. Carburizing temperatures in excess of 1750 F are seldom used in industrial practice. The common range is 1675 to 1725 F, and 1700 F is the predominant temperature.

Many different materials and methods are used for carbon enrichment but the general industrial practices are: (1) pack method, (2) gas method (including oil vapors), and (3) liquid salt method. Some plants may employ any one or all three methods, because each has its advantages.

Sometimes, the impression is given that one or another method is faster. Based on total elapsed time this is true, but the essential difference in time is due to the longer interval necessary in bringing the article to be carburized up to the carburizing temperature. When the carburizing temperature is once attained the speed thereafter to obtain a given case depth is much the same for any of the three methods, pack, gas or liquid salt, provided that the temperature and time are the same and that the carburizing media are of the same carbon potential.

Many factors are involved in the choice of a respective method, and it hardly can be said broadly that any one method is superior. Matters to be considered are the variance in size, shape, volume and similar characteristics that prevail in the articles to be treated, and the dissimilar conditions that exist in different industrial plants.

Absorption of carbon is only the initial step in the carburizing heat treatment. Many other phases are involved: diffusion of the carbon inward, retention of carbon or prevention of decarburization, and method of cooling, that is, whether to harden directly or to cool and reheat for hardening. Other factors to be considered are: the type of steel, carburizing medium, temperature, type of equipment, degree of technical control, case characteristics, and freedom from distortion.

When carburized steel is slowly cooled through its lower transformation range, the case becomes relatively soft, about Rockwell C 30. This is due to formation of pearlite, the excess carbide becoming a network surrounding the pearlite grains. Pearlite is a compound of alpha iron and iron carbide and is relatively soft, being made up of alternate plates or lamellae of ferrite and carbide. Pearlite will have a hardness of about 207 Brinell. The network of carbide has little effect in raising the hardness.

When carburized steel is quenched at a rate equal to or exceeding the critical cooling rate—as when plunged into oil, water or brine—the enriched carbon content has no opportunity to agglomerate or grow or separate out to form an impotent network. Instead, it becomes finely dispersed throughout the transformed alpha iron (ferrite) and forms high-carbon martensite. This microconstituent is very hard.

PACK CARBURIZING

Of the three carburizing methods, the pack process, also known as box carburizing, is the oldest and most widely used. While the method is gradually losing ground to gas carburizing in popularity, it still remains the most foolproof and is perhaps the most versatile

method in accommodating wide ranges in geometry of parts.

Control of the pack carburizing process is not involved. It consists essentially of heating the articles at a suitable temperature in containers, in which the work is surrounded by compound whose purpose is to furnish carbon for absorption by the steel.

Most current carburizing compounds fall into two classes: (1) charcoal-coke and (2) coke type. Both kinds contain 15 to 20% alkali carbonates or other compounds of sodium, barium or calcium as "energizers," whose action is similar to a catalyst. The role of the energizers is believed to be that of furnishing carbon dioxide, which in turn reacts with incandescent carbon to form an additional supply of carbon monoxide. When the compound is heated to carburizing temperatures, carbon monoxide is formed. It reacts as nascent or atomic carbon at the surface of the steel and migrates inward by a solid diffusion process, according to the current conception.

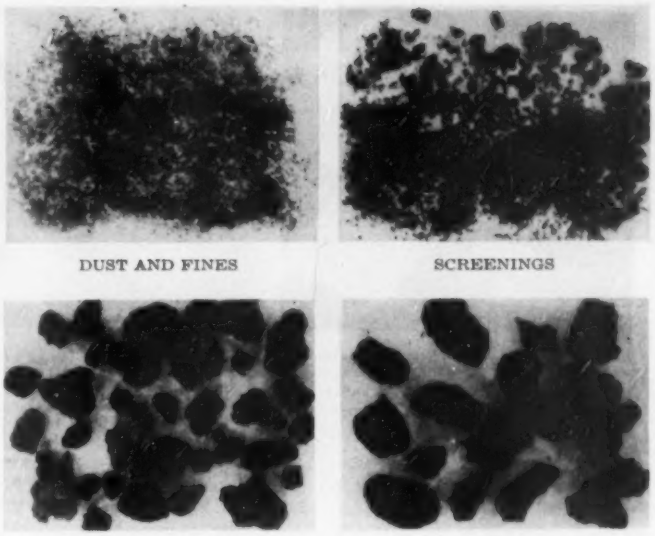


Fig. 3 .. Particle size of working mixture of carburizing compound is shown at lower left for work ranging from 1/2 to 100 lb. The compound is a high-percentage petroleum coke of the non-burning type

Carburizing Compounds

Charcoal-Coke Compound. The carbonaceous phase of the compound generally runs about three parts charcoal to one of coke. General practice is to employ charcoal made from hard wood. The coke may be either of bituminous or petroleum derivation. Energizers are bound to the carbon-base materials by tar, molasses, water or petroleum oil, which may merely coat the surface of the compound granule or may be impregnated throughout the granule.

Working mixtures of the charcoal-coke type generally run from one part new to three parts old compound to as high as one part new to five parts old. Higher ratios are not often used because charcoal has a high burning loss, and because the energizers gradually dust off with continued use. Ratios of new to old depend on factors in each plant, such as: physical condition of carburizing boxes and covers, whether direct quenching is employed, the efficiency and size of opening in cleaning screens, the carburizing temperature, and the type of handling system.

Compound loss depends on several factors. If carburizing boxes contain large openings and the covers fit badly, excessive burning of the compound results. When direct quenching, the degree to which the compound remains exposed to air determines the extent of burning losses from this source. Screen openings may allow too many granules to be thrown away. They should be carefully studied for retention of the correct particle size. The correct size insures positive carburizing action by allowing maximum circulation of gases and heat within the loaded pot or box. Pneumatic handling systems may break down particles if they make many turns in direction or travel at excessive speeds due to high suction. Bucket type conveyors apparently cause least damage to compound. Vibratory conveyors are proving satisfactory, one advantage being a quicker regenerative effect from free exposure to air. Fast cooling of the compound to repacking temperature is also accomplished by this method.

The mechanical-handling equipment should not dictate the working mixture used, but should be subordinated to the mixture of new and old that will give the desired carbon concentration in the quickest time possible. Depleted compounds—that is, where the energizer is at a low state of activity and erratic carburizing occurs—can be avoided by keeping additions of new compound high enough, even if some of compound in use must be discarded.

Heat transfer is slow through solid carburizing compounds, but accumulation of fines and dust invites trouble. They cause both lower case depth and carbon concentration than when the compound is properly handled and screened to maintain the correct particle size. Keep compound particle size large enough to insure good heat transfer and free circulation of carburizing gases within the carburizing pot. With dust and fines excluded, the work quenches out cleaner and the quenching oil becomes less contaminated.

Coke-Type Compound. While charcoal-coke compound is still used in volume, the high-percentage coke type known as the "non-burning" is rapidly becoming popular. The essential difference is the replacement of part or all of the charcoal ingredient with coke

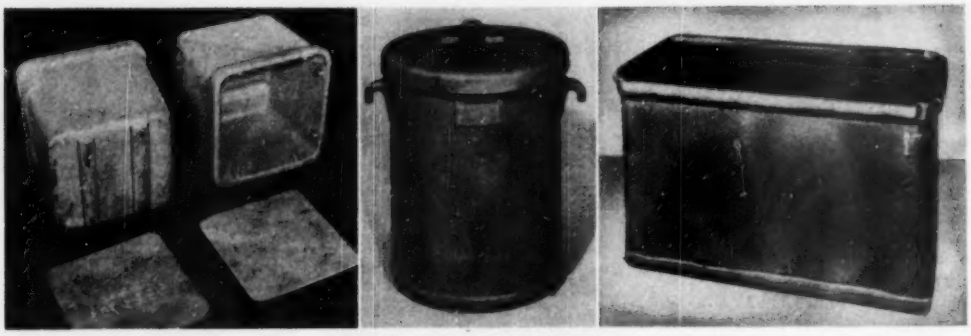


Fig. 4 .. Carburizing boxes are cast or fabricated of heat-resisting alloy. Left—Bottom of cast box is ribbed to permit heat circulation around underside. Cover fits into box opening, rests on lugs. Center—Most sheet pots are cylindrical, and their design varies according to handling and warpage-resistance requirements. Right — Fabricated box has top edge rolled over and welded to increase rigidity, resist warpage

of petroleum or bituminous origin. Coke burns slowly in comparison to charcoal. Hence, ratios as high as eight parts old to one part new compound are employed, and there is greater freedom from dust.

Cellular structure of coke permits more thorough impregnation with energizer to add service life. The coke compound is cleaner to handle, makes for better shop conditions. Generally, the weight per cubic foot of the coke type is somewhat more than the charcoal-coke type but this difference does not always hold true.

Actually, the term "non-burning" is not true, because the coke compound will burn away gradually but not so readily as the charcoal-coke type nor does it have as high a shrinkage loss. Sometimes too low a shrinkage loss becomes a liability, because low additions of new compound supply insufficient new energizer, and thus cause depleted activity, resulting in reduced carburizing efficiency. Where direct quenching from the carburizing pots is employed, the non-burning type is quite generally used because of its slow burning characteristics.

It hardly can be said that either of the two compounds, namely, the charcoal-coke or the non-burning coke type, will carburize faster than the other because the activity is a function of the mixing formula, energizer and temperature. Compounds containing sodium-bearing energizers are generally more active than the same compounds without sodium additions. Sodium-bearing compounds are also regarded as reducing somewhat the life of the carburizing containers.

Compound manufacturers as a rule make a standard product, but do modify these formulas to satisfy some unusual requirement. Particle size is governed by the product carburized, and should be in proportion to the product size. Maximum permissible particle size should be sought so that free circulation of gases and rapid heat transfer are realized.

Packing procedures are somewhat the same for either type of compound, and are governed considerably by the shrinkage factor. Articles should not be placed too close to each other or to the sides, top and bottom of containers if high-shrinkage compounds are used. Obviously, the spacing will change as the compound burns away. Depending upon compounding formulas, shrinkage may run from 15% down to 5%. Experience will dictate the best practice to follow in packing. A good rule is a spacing of ½ to 1 in. between container and part and between individual parts, after having gone through the carburizing cycle. This distance should guarantee sufficient gas generation properly to carburize the part.

Some plants are equipped for automatic mixing of definite proportions of old to new compound; others manually mix the proportions by shoveling. If mechanical or automatic mixing equipment is not available, put the new additions into the bottom of the container when packing. The new compound is charred on the first run before coming into contact with the work. When the container is dumped, the new compound becomes dispersed throughout the working volume.

Current practice in up-to-date shops is to employ direct quenching wherever possible. If pot cooling is used, provide means to cool the compound and contents to black heat as quickly as possible to overcome the tendency for decarburization.

In some instances, work can be dumped and air cooled. Slight oxidization or scaling of parts from exposure to air usually disappears in the following reheating operation. This method of cooling is frequently employed to avoid decarburization, or depletion of surface carbon content. Other ways to hasten cooling of the work in the containers are: (1) remove the covers, (2) direct an air stream over the containers, or (3) use relatively thin containers of alloy heat-resisting sheet.

Carburizing Pots or Boxes

Designs of carburizing pots or boxes are varied. Important factors are: contour and size of part to be treated, type of heat treating equipment available, handling methods, and required quality of the finished part.

Carburizing-pot design is of major importance in keeping down costs of the carburizing operation.

Sturdiness must be balanced against heat transfer and weight. Day in and day out the containers must withstand repeated exposure to high temperatures followed by cooling to room temperature, either in the open or in the furnace. Premature deterioration cannot be tolerated because of high initial cost. Therefore, the design must be correct to withstand repeated thermal shock.

Containers must be strong enough to hold the work and withstand handling at elevated temperatures, particularly when removing from the furnace for direct quenching. They should not be too bulky nor massive for handling. The lightest possible wall thickness commensurate with good design should be used to permit rapid heat penetration to the center of the charge to eliminate differences in case depth throughout the pot.

Two basic pot designs seem most popular: (1) complete casting, and (2) fabricated rolled sheets. For the same cubical content, sheet boxes are lighter than cast boxes. Familiar designs are square, rectangular and cylindrical. Many modifications of these basic designs are encountered. Cast boxes range in wall thickness from ¼ to ⅝ in.; fabricated boxes from ⅛ to ⅜ in. Casting of boxes less than 7/16 in. thick introduces problems. Sheet boxes are customarily made of ⅛ and 3/16 in. stock. Covers usually have the same wall thickness as the pots. Bottoms thicker than sides prolong life of sheet pots.

Minimizing Deformation

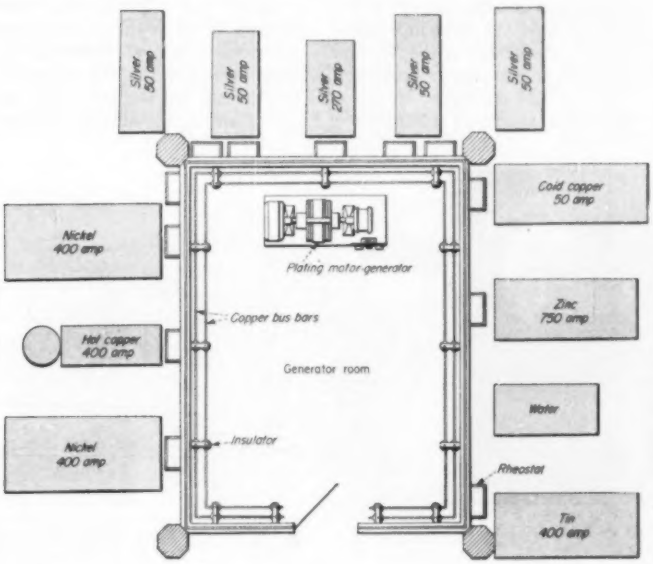
Various means are employed to prevent or minimize deformation of containers from repetitive thermal changes. Ribbing, articulation, pinning, interlocked sections and other means are used to combat natural stresses encountered during heating to and cooling from carburizing temperatures.

Almost important as design are the materials from which the containers are made. Only occasionally is ordinary cast iron, cast steel, pipe or sheet used. Customary practice is to specify heat-resisting alloy such as 25% chromium-12% nickel, 25% chromium-20% nickel, 25% nicked-20% chromium, 35% nickel- 15% chromium, 60% nickel- 12% chromium and 80% nickel- 13% chromium. The higher the nickel content the less the carbon absorption, and hence the lower the tendency for the carburizing compound to carburize through the container walls. Such action causes brittleness and lowered resistance to thermal shock. The 80% nickel-13% chromium alloy has been known to give from two to thre times the life of 35% nickel-15% chromium alloy, especially in fabricated, rolled-sheet containers. By constant vigilance, early failure of containers can be minimized by welding shut the first evidence of porosity, an opening or crack, using welding wire corresponding to container metal.

Part II of "Good Carburizing Practice" will appear in the October 30 number.

PLATING ROOM LAYOUT CUTS POWER LOSSES

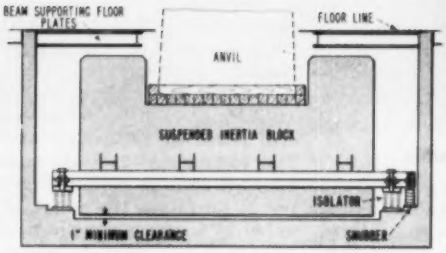
BY GEORGE POHLMANN, Assistant Factory Mgr.
Machinery Division, THE LIQUD CARBONIC CORP.



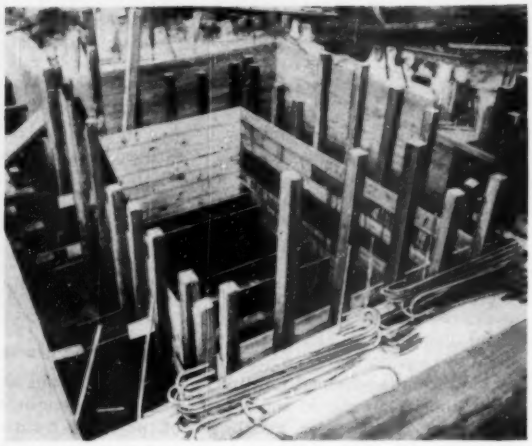
QUALITY of electroplate deposited on a wide range of parts is easier to control in the new plating room recently completed at the Chicago plant of The Liquid Carbonic Corp. By placing the motor-generator set in the center of the plating room, and positioning the tanks around the walls of the generator enclosure, length of leads is held to a minimum and power losses are low.

Two ¼x4-in. copper bus bars are supported by insulators around the inside of the generator room walls, permitting use of short leads to the control rheostats and tanks.

Of equal importance has been the installation of an air supply and exhaust system to serve the 100x80-ft. plating room. Two blowers deliver a total of 23,260 cfm of filtered air to the generator room and the plating room at required points. Two exhaust units draw 28,585 cfm through hoods over the tanks. Supply and exhaust ducts also serve cleaning and chromium plating tanks in the room.



1 **Isolated hammer** is supported by springs under I-beams crossing through concrete foundation block



2 **Concrete pit** is poured and lined with waterproof paper, then I-beams are laid and forming built for concrete foundation block

HAMMER ISOLATION PROVES ITS WORTH

BY C. H. SMITH, JR., President, STEEL IMPROVEMENT & FORGE CO.

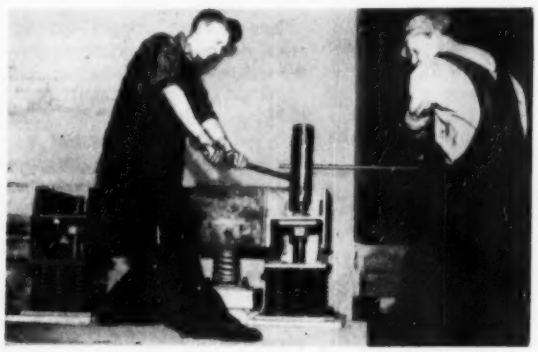
SIX forging hammers mounted on springs have now been in use for a year at Steel Improvement & Forge Co., Cleveland, and it is possible to assess the results.

The hammers are mounted in a common pit with separate foundation blocks of reinforced concrete. They include three Ceco-Drop hammers, 1500-, 2000-, and 3000-lb, and three board drop hammers, 2000-, 2000-, and 2500-lb.

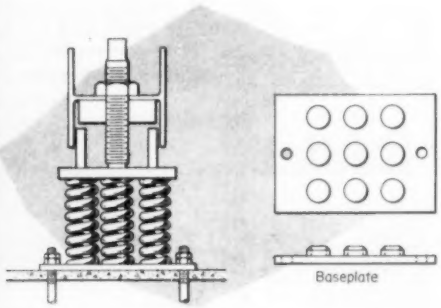
Four 25,000-lb spring isolators and snubbers are used on the 1500-lb hammer. Eight of the same isolators and six snubbers are required for the 3000-lb hammer. Each of the other four hammers has six isolators and four snubbers. The pictures show the steps in installation and the design of the Korfund isolators and snubbers employed.

A test was conducted on one of the hammers and on a hammer of the same model with conventional mounting. One blow was struck on an alloy steel slug 1.504 in. high. The conventional hammer compressed the slug to 1.065 in. and the isolated hammer to 1.049 in.

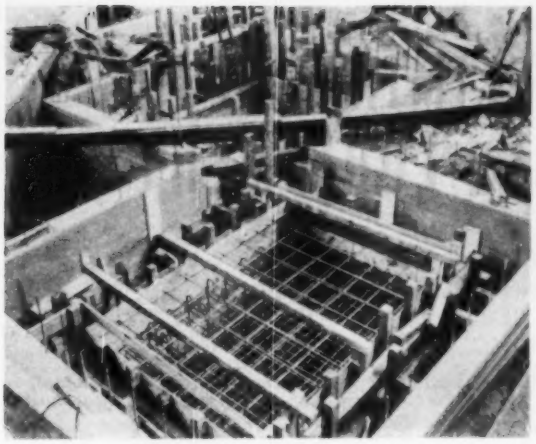
Such a test is hardly conclusive because there might be variations in steel or hammers. However, our experience confirms the test to the extent that we are convinced the use of spring mountings does not



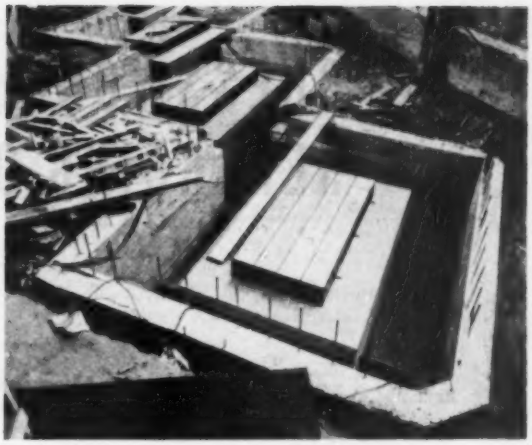
5 **Isolator adjusting bolt** serves as leveling jack and lifts foundation block from waterproof paper which lined the pit



6 **Isolator** has nine coil springs, will carry loads up to 25,000 lb



3 **Steel reinforcing rods** are positioned in foundation forms. Concrete must be good grade and fully cured before use



4 **Single layer of timbers** is held on foundation blocks by clip angles or a concrete curb

Steady use for a year of six forging hammers mounted on springs confirms predictions of the value of vibration isolation

decrease hammer efficiency, and may increase it very slightly.

In other respects the isolated foundations have fully lived up to expectations. We have had no trouble with cracking or spalling of the foundation blocks. Where this has occurred it has apparently been caused by an inferior mixture of concrete or insufficient cure time before operating the hammers.

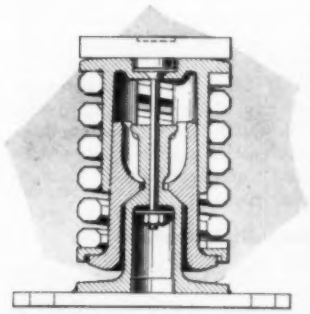
Maintenance costs on the hammers have been less than for other hammers. On drop hammers lifted by a steel rod, we have had no difficulty with rods pulled from the hammer. But isolation seems to have no effect on the life of boards in board-drop hammers.

In a forging plant where there are many hammers not mounted on springs, it is difficult to assess the effect of isolation of a few hammers. Certainly working conditions are better in the building containing the isolated hammers (and no others).

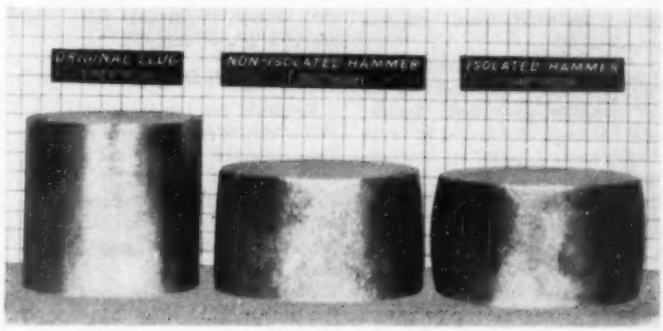
The floor is completely free of vibration, even with all six hammers operating, and this makes less fatigue for hammermen and their helpers.

The foundations move no more than the anvil of a non-isolated hammer and only after the blow energy has been delivered to the work. The adjustable mechanical snubbers limit oscillation to one cycle.

So far there has been no failure of springs or snuboers. If there should be, they can be easily replaced because of the pit design which allows access around the foundation block to the isolators. This access is also desirable to clean out scale or other debris that may work down between the floor plates and anvil to the foundation.



7 **Mechanical snubber unit** limits vibration to one cycle through friction



8 **Test** of two identical hammers striking one blow on alloy steel slugs. Isolated hammer gave slightly more force than non-isolated hammer

GUESSWORK ELIMINATED IN REPLACING OLD EQUIPMENT

BY BURNHAM FINNEY, EDITOR

Barber-Colman makes 2-way use of method of replacement analysis based on MAPI system—to buy new machines, and to sell its own product

A METHOD of replacement analysis is being used successfully by the Barber-Colman Co., Rockford, Ill., to decide whether it should replace old production equipment in its plant with new machinery. What's more, the company's salesmen are making use of this "replacement analysis" as a sales tool to convince customers that they should buy Barber-Colman hobbing machines and textile machinery.

Benefits

The replacement analysis is based on the machinery replacement system developed by the Machinery & Allied Products Institute. As a result of its application, Barber-Colman reports these benefits:

1. Funds for replacement of old equipment are being spent to the best possible advantage. Guesswork has been eliminated in favor of arithmetical proof of savings.
2. It is now possible to determine the economics of buying new equipment to perform operations in the Barber-Colman plant which heretofore have been subcontracted to other companies.
3. The management now knows how expensive it will be if old machinery is retained as well as how much will be saved if new machines are bought.
4. A program is under way to review every piece of plant equipment at regular intervals according to the "replacement analysis" now in use.
5. Shop supervisors are more conscious than ever before of the good or bad performance of machinery in their own departments. They cooperate by furnishing detailed facts about old equipment and the need for new.

At the core of the Barber-Colman "replacement analysis" program is a methods department to which all requests for analysis are made. The analyst in this department gathers all essential data from all sources. He goes to the production - control department and to other staff departments for production information pertinent to the problem at hand.

Each analysis is reviewed by the methods and the production-control department before it is sent for a decision to the works manager. This procedure insures that every important factor is covered in the analysis.

How Requests Originate

Requests for replacement analysis originate from several sources. The methods department is the most frequent source. It is on the alert all the time to reduce overall costs. Foremen and superintendents are another likely source. Any requests which they may make usually are discussed with the production-control manager or the works manager before the analysis is begun, if it appears to the methods department that the analysis is likely to show little or no replacement gain.

The works manager and the general manager sometimes ask for a replacement analysis. Other management executives also may make similar requests.

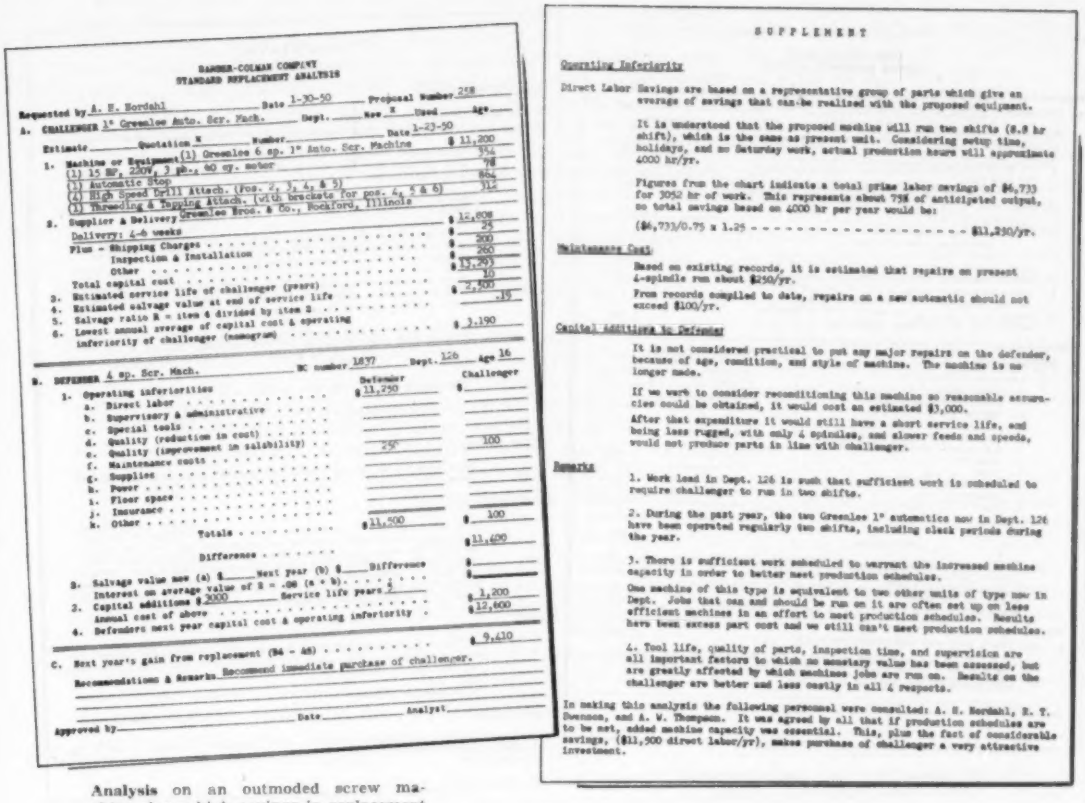
A request for a replacement analysis may involve any of these factors:

1. Replacement of one machine by a newer model of the same machine.
2. Replacement of one machine by a different machine.
3. Replacement of a group of machines by one or a group of different machines.
4. Replacement of a hand operation by a machine or a group of machines.
5. Elimination of a complete process or work shift by additional machinery.

The analysis takes into consideration the capital investment required for the particular installation, the probable service life of the new equipment, the interest rate to be used, and all the factors in determining the capital costs and operating inferiorities of the equipment. These factors are: direct labor saving, supervisory and administrative costs, special tools, quality factor, maintenance costs, cost of supplies, power, floor space, insurance, and miscelaneous items.

Competitive Analyses

It may be necessary, in some cases, to analyze separately several "makes" of new equipment or several different competitive ar-



BARBER-COLMAN COMPANY
STANDARD REPLACEMENT ANALYSIS

Requested by A. H. Nordahl Date 1-30-50 Proposal Number 248

A. CHALLENGER 1" Greenlee Auto. Scr. Mach. Dept. ____ New X Used ____ Age ____

Estimate ____ Quotation X Number ____ Date 1-23-50

1. Machine or Equipment (1) Greenlee 6 sp. 1" Auto. Scr. Machine $ 11,200
(1) 15 Hp., 220V, 3 ph., 60 cy. motor 374
(1) Automatic Stop 78
(4) High Speed Drill Attach. (For pos. 2, 3, 4, & 5) 804
(1) Threading & Tapping Attach. (with brackets for pos. 4, 5 & 6) 312

2. Supplier & Delivery Greenlee Bros. & Co., Rockford, Illinois $ 12,808
Delivery: 4-6 weeks $ 25
Plus - Shipping Charges $ 200
Inspection & Installation $ 260
Other $ 13,293
Total capital cost 10
3. Estimated service life of challenger (years) $ 2,400
4. Estimated salvage value at end of service life .19
5. Salvage ratio R = item 4 divided by item 2
6. Lowest annual average of capital cost & operating inferiority of challenger (nomogram) $ 3,190

B. DEFENDER 4 sp. Scr. Mach. MC number 1837 Dept. 126 Age 16

	Defender	Challenger
1. Operating inferiorities		
a. Direct labor	$ 11,250	$
b. Supervisory & administrative		
c. Special tools		
d. Quality (reduction in cost)		
e. Quality (improvement in salability)	250	100
f. Maintenance costs		
g. Supplies		
h. Power		
i. Floor space		
j. Insurance		
k. Other		100
Totals	$ 11,500	$ 11,400
Difference		$
2. Salvage value now (a) $ ____ Next year (b) $ ____ Difference		$
Interest on average value of 2 = .06 (a + b)		
Capital additions $ 2000 Service life years 7		$ 1,200
Annual cost of above		$ 12,600
4. Defenders next year capital cost & operating inferiority		$ 9,410

C. Next year's gain from replacement (B4 - A6)

Recommendations & Remarks Recommend immediate purchase of challenger.

Approved by ____ Date ____ Analyst ____

SUPPLEMENT

Operating Inferiority

Direct Labor Savings are based on a representative group of parts which give an average of savings that can be realized with the proposed equipment.

It is understood that the proposed machine will run two shifts (8.8 hr shift), which is the same as present unit. Considering setup time, holidays, and no Saturday work, actual production hours will approximate 4000 hr/yr.

Figures from the chart indicate a total prime labor savings of $6,733 for 3052 hr of work. This represents about 75% of anticipated output, so total savings based on 4000 hr per year would be:

($6,733/0.75 x 1.25 - $11,250/yr.

Maintenance Cost

Based on existing records, it is estimated that repairs on present 4-spindle run about $250/yr.

From records compiled to date, repairs on a new automatic should not exceed $100/yr.

Capital Additions to Defender

It is not considered practical to put any major repairs on the defender, because of age, condition, and style of machine. The machine is no longer made.

If we were to consider reconditioning this machine as reasonable accuracies could be obtained, it would cost an estimated $3,000.

After that expenditure it would still have a short service life, and being less rugged, with only 4 spindles, and slower feeds and speeds, would not produce parts in line with challenger.

Remarks

1. Work load in Dept. 126 is such that sufficient work is scheduled to require challenger to run in two shifts.

2. During the past year, the two Greenlee 1" automatics now in Dept. 126 have been operated regularly two shifts, including slack periods during the year.

3. There is sufficient work scheduled to warrant the increased machine capacity in order to better meet production schedules.

One machine of this type is equivalent to two other units of type now in Dept. Jobs that can and should be run on it are often set up on less efficient machines in an effort to meet production schedules. Results have been excess part cost and we still can't meet production schedules.

4. Tool life, quality of parts, inspection time, and supervision are all important factors to which no monetary value has been assessed, but are greatly affected by which machines jobs are run on. Results on the challenger are better and less costly in all 4 respects.

In making this analysis the following personnel were consulted: A. H. Nordahl, R. T. Swenson, and A. W. Thompson. It was agreed by all that if production schedules are to be met, added machine capacity was essential. This, plus the fact of considerable savings, ($11,500 direct labor/yr), makes purchase of challenger a very attractive investment.

Analysis on an outmoded screw machine shows high savings in replacement

rangements. For simplicity, the equipment to be displaced (or lack of it) is called the "defender" and the new equipment is the "challenger", terms used in the MAPI system. Bear in mind that there may be more than one challenger.

The analyst looks into all the factors which affect the operating inferiority of the defender (machine to be replaced). Direct labor saving is one of the most important . . . Such savings may arise from any one or several of these factors:

1. Machine speeds and/or feeds may be different.

2. Different machines have different "make-ready" or "setup" times.

3. Operating time may be reduced. Controls may be more conveniently located. Rapid traverse may be available. Strength, rigidity, and power may vary. The method may be altered (cutters made of carbide, or sawing done by the friction process). Automatic features may provide multiple machine operation. The machine may be designed so that it can pace the operator rather than the operator pacing the machine.

4. Handling time, direct or indirect, may be altered by location and adaptation of magnetic and hydraulic holding attachments, and by built-in inspection features.

5. Displacement of hand labor.

6. Reduction of auxiliary labor used for such work as stock supply, stock loading, and moving or cleaning the product.

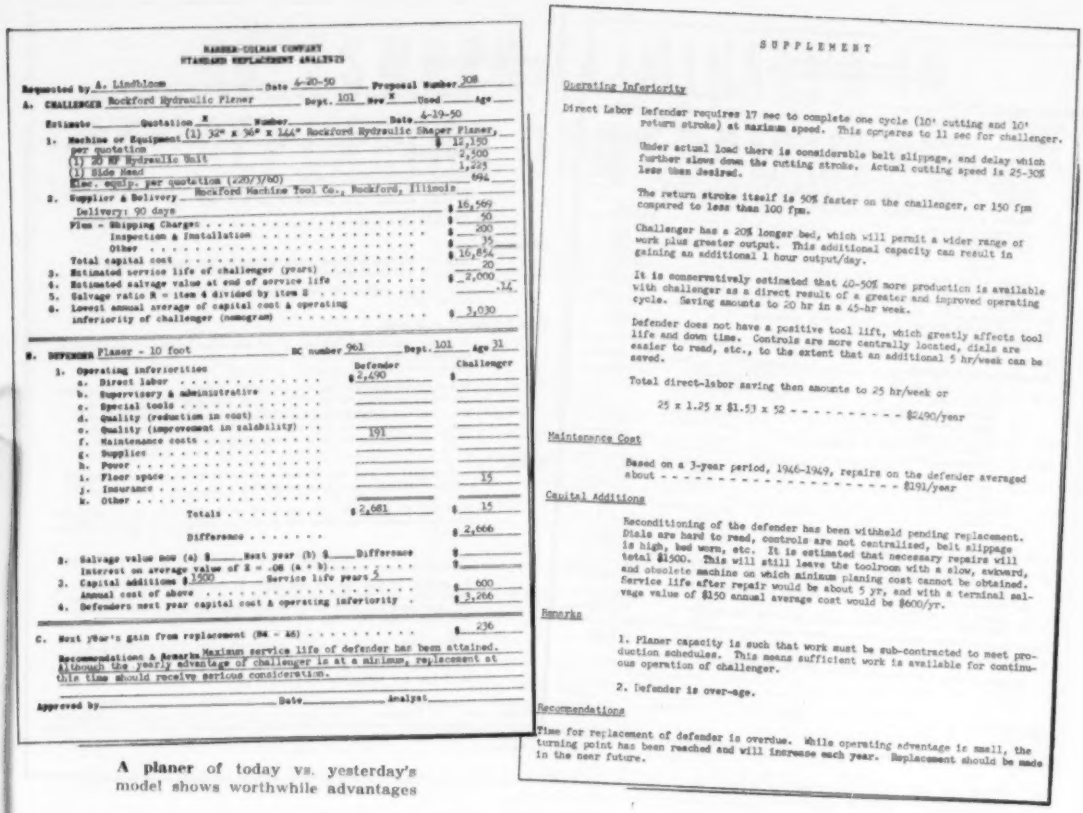
Direct Labor Cost

Certain items should be added to a man's rate in computing direct labor cost: such as overtime premiums, production bonus premiums, annual bonus, profit-sharing plans, paid vacations, Social Security tax, and insurance and other benefits paid by the company.

These extra costs may vary with the individual employee, but Barber-Colman accounts for the extra cost by multiplying a man's straight-time rate by 1.50, or the average hourly earnings of a department by 1.25.

In numerous cases, the analyst will have to determine the actual savings which can be made on specific parts to be processed which can be diverted to the contemplated new machine.

Supervisory and administrative costs should not be taken into account in most analyses of single machines. Supervisory and/or administrative help should be chalked up as a positive saving only when the help can be eliminated or the effort diverted to



BARBER-COLMAN COMPANY
STANDARD REPLACEMENT ANALYSIS

Requested by A. Lindblom Date 6-20-50 Proposal Number 308

A. CHALLENGER Rockford Hydraulic Planer Dept. 101 New X Used Age

Estimate Quotation X Number Date 6-19-50

1. Machine or Equipment (1) 32" x 56" x 144" Rockford Hydraulic Shaper Planer, per quotation $ 12,150
(1) 20 HP Hydraulic Unit 2,500
(1) Side Head 1,225
Elec. equip. per quotation (220/3/60) 694

2. Supplier & Delivery Rockford Machine Tool Co., Rockford, Illinois
Delivery: 90 days $ 16,569
Plus - Shipping Charges $ 50
Inspection & Installation $ 200
Other $ 35
Total capital cost $ 16,854
3. Estimated service life of challenger (years) 20
4. Estimated salvage value at end of service life $ 2,000
5. Salvage ratio R = item 4 divided by item 2 .14
6. Lowest annual average of capital cost & operating inferiority of challenger (nomogram) $ 3,030

B. DEFENDER Planer - 10 foot BC number 961 Dept. 101 Age 31

	Defender	Challenger
1. Operating inferiorities		
a. Direct labor	$ 2,690	$
b. Supervisory & administrative		
c. Special tools		
d. Quality (reduction in cost)		
e. Quality (improvement in salability)		
f. Maintenance costs	191	
g. Supplies		
h. Power		
i. Floor space		15
j. Insurance		
k. Other		
Totals	$ 2,681	$ 15
Difference		$ 2,666
2. Salvage value now (a) $ Next year (b) $ Difference		$
Interest on average value of $ = .06 (a + b)		$
3. Capital additions $ 1500 Service life years 5		
Annual cost of above		$ 600
4. Defenders next year capital cost & operating inferiority		$ 3,266

C. Next year's gain from replacement (B4 - A6) $ 236

Recommendations & Remarks Maximum service life of defender has been attained. Although the yearly advantage of challenger is at a minimum, replacement at this time should receive serious consideration.

Approved by Date Analyst

SUPPLEMENT

Operating Inferiority

Direct Labor Defender requires 17 sec to complete one cycle (10' cutting and 10' return stroke) at maximum speed. This compares to 11 sec for challenger.

Under actual load there is considerable belt slippage, and delay which further slows down the cutting stroke. Actual cutting speed is 25-30% less than desired.

The return stroke itself is 50% faster on the challenger, or 150 fpm compared to less than 100 fpm.

Challenger has a 20% longer bed, which will permit a wider range of work plus greater output. This additional capacity can result in gaining an additional 1 hour output/day.

It is conservatively estimated that 40-50% more production is available with challenger as a direct result of a greater and improved operating cycle. Saving amounts to 20 hr in a 45-hr week.

Defender does not have a positive tool lift, which greatly affects tool life and down time. Controls are more centrally located, dials are easier to read, etc., to the extent that an additional 5 hr/week can be saved.

Total direct-labor saving then amounts to 25 hr/week or

25 x 1.25 x $1.53 x 52 - - - - - - - - - - $2490/year

Maintenance Cost

Based on a 3-year period, 1946-1949, repairs on the defender averaged about - $191/year

Capital Additions

Reconditioning of the defender has been withheld pending replacement. Dials are hard to read, controls are not centralized, belt slippage is high, bed worn, etc. It is estimated that necessary repairs will total $1500. This will still leave the toolroom with a slow, awkward, and obsolete machine on which minimum planing cost cannot be obtained. Service life after repair would be about 5 yr, and with a terminal salvage value of $150 annual average cost would be $600/yr.

Remarks

1. Planer capacity is such that work must be sub-contracted to meet production schedules. This means sufficient work is available for continuous operation of challenger.

2. Defender is over-age.

Recommendations

Time for replacement of defender is overdue. While operating advantage is small, the turning point has been reached and will increase each year. Replacement should be made in the near future.

A planer of today vs. yesterday's model shows worthwhile advantages

other work (machines might be bought, for example, which would result in elimination of an entire department).

If a new machine should do away with many special tools, the annual value of these tools should be computed.

Product Quality

The quality factor sometimes will loom large as a consideration. The challenger (machine to be bought) may improve greatly the quality of the product. This improvement may show up as an operating inferiority of the old machine in two ways: reduction in cost and increase in salability of the product. Lower cost may stem from adaptability of the part in subsequent operations, elimination of subsequent operations (finish may be so much better that a grinding or other secondary operation is unnecessary), reduction in spoilage, decrease or elimination of inspection time.

Improvement in salability may arise from the fact that the quality of the finished product may be enough better to justify a higher selling price or to widen the market for the product.

The age of a machine and its continued use often may result in excessive maintenance costs, which then become a prime consideration in the replacement analysis. The annual maintenance cost, incidentally, refers only to the regular cost of maintenance and not to the cost of rebuilding the machine. The figure to be used in assessing maintenance cost is the difference between next year's maintenance of the defender as against next year's maintenance of the challenger.

Three other points are weighed in determining maintenance costs. *First*, two machines may vary in routine preventitive maintenance time. Example: the time required for lubricating or changing hydraulic oil may differ. *Second*, high maintenance costs may reduce the production time available on the machine. In other words, the downtime may be excessive. *Third*, two machines may vary in the ease with which they can be repaired.

Cost of Supplies

The cost of supplies often is a real factor in comparing the old machine with the proposed new one. One type of machine may use cheaper cutting tools, or holding tools than another type. To be specific, hacksaw blades cost less than bandsaw blades, and HSS cutters cost less than their equivalent in carbides.

Some machinery may require more time than others for replacing cutting tools, the actual time depending on rigidity, speeds available, and method used. Machines may take different qualities and quantities of lubricants and coolants, may require hydraulic fluids in varying amounts.

Power is essential to run the machines: costs of power should be computed for the challenger against the defender.

If there is to be any saving in floor space with installation of the new machine, the difference is figured at a standard price of $1 per sq ft each year. Insurance cost is arrived at by multiplying by 0.001 the difference in cost of the new equipment less the salvage value of the old.

Salvage Value

Determination of the salvage value of the defender (old machine) is not always easy. Many times it will be little more than the scrap value. If the old machine is transferred to another department, the analyst estimates the probable salvage value, of the machine if kept another year. The difference between the current salvage value and next year's estimated salvage value, plus interest on the average value, is considered part of capital cost of the old machine for the next year.

After all of the factors just described have been arrived at, the defender's operating inferiority and the challenger's operating inferiority are determined. The analyst form shown on this page is used for this purpose. After the proper entries, in the two columns, the difference between the totals is the total operating inferiority of the defending machine.

When the loss of salvage is added, the result is the defender's next year's total of capital cost and operating inferiority. Since only in rare cases is this total more than the succeeding year's total, it is not necessary to compute the figure for any other year. The only case where this statement is not true is one in which the loss of salvage next year will be much more than the loss of salvage in succeeding years. In such a case, a much more complicated procedure is required.

Occasionally an existing machine must have a major repair or an addition to it to continue operating as it should. When this happens, the cost of the addition must be determined or estimated and the annual average of the capital cost and operating inferiority of the addition computed in accordance with this formula:

$$C\left(\frac{2N-1}{N^2}+0.1\right)$$

In this formula, C is the capital cost just determined, and N is the estimated service life of the defender with the capital addition. In estimating this service life, the analyst should consider that the machine itself is approaching retirement and its remaining service life probably will be short. Such service life is the time during which it can justify itself in relation to challengers. The value derived from this formula is to be added to the defender's operating inferiority. Salvage value of the defender is not taken into account in this case.

Service Life

There are several ways to determine the lowest annual average of capital cost and operating inferiority for the challenger. To avoid confusion, Barber-Colman uses only one method which involves estimating the service life. The service life is the length of time during which the new machine will not be replaceable by another machine or method on which a replacement analysis of this same sort would show it to be uneconomical to retain the old machine.

If Barber-Colman had regularly adhered over a long time to a policy of retiring all machines upon the basis of a replacement analysis, the records for the type of machine in question would be the best evidence of the probable correct service life for the new machine. Since records are not at hand, service life estimates are based partly on records which the company has accumulated over the past few years and partly on miscellaneous information obtained elsewhere. The range in which the service life usually will fall (10 to 20 years) is such that an error of a few years in the estimate ordinarily will not produce a large error in the result.

An estimate should be made of the salvage value of the challenger at the end of the estimated service life. Often this value will be small. If the service life is long, omission of this estimate, or the use of zero for the value, will result in only a slight error.

If the salvage value is estimated, however, the ratio obtained by dividing the salvage value by the original cost must be secured.

Adverse Minimum

Having estimated the life and the ratio of salvage value to original cost, and knowing the total cost, Barber-Colman Company obtains the adverse minimum for the challenger from a nomogram but this figure is correct only for the Barber-Colman interest rate. The adverse minimum for any interest rate can be obtained from a chart accompanying the MAPI Replacement Manual.

The adverse minimum above referred to, which is the lowest annual average of capital cost and operating inferiority for the challenger, is to be compared with a similar figure previously obtained for the defender. The two figures may turn out to be identical, or nearly so. Should that happen, it will make no difference theoretically whether or not the new machine is bought immediately, but in most cases the application of the above formula makes crystal clear the decision as to whether the new machine should be purchased.

The fact should not be lost sight of that it may be necessary to make a separate analysis for two or more challengers, with different prices, different capital costs, different savings, and different salvage values. The challenger which shows the greatest favorable difference between its adverse minimum and that of the defender is the one which should be purchased.

TEMPLETS LOCATE END-WELDED STUDS

Accurate location and perpendicular positioning of end-welded studs can be insured by simple, inexpensive templets

BY H. W. BARTLEY, Design Engineer, Nelson Stud Welding Div., MORTON GREGORY CORP.

ALTHOUGH the Nelson stud-welding process was invented to speed ship production, Metalworking applications have made it necessary to develop stud-locating techniques to maintain dimensional accuracies.

Stud welding is essentially a shielded-arc welding process performed by a lightweight, portable gun. Studs can be threaded, plain, or in a variety of special shapes. Only practical limitations are that the weld end must be shaped so it can be flux filled or slug loaded, and that the other end can be chucked into the gun. Studs as long as 36 in. and as large as 1 in. in dia, with weld base reduced to ¾-in. dia, have been stud welded.

In welding, the stud and a protective ceramic ferrule are chucked in the gun, and pressed against the work in the proper location. The operator then presses the trigger, and a solenoid completes the welding circuit and lifts the stud approximately 1/16 in. from the work. At the same time, the mainspring is compressed. The arc thus formed between the stud and the work forms a pool of molten metal, and at the proper instant the solenoid is automatically de-energized and the stud plunged into the work by the mainspring. An adjustable timer control unit determines the length of the weld cycle, which is dependent upon the diameter of the stud and the type of metal.

The gun can be used either as a hand-operated tool or as a semi-automatic mass-production machine, depending upon the type and quantity of work. In either case, success of the operation depends upon welding the stud in the desired location.

Several methods of templeting and other stud-locating devices are now in use. In many instances, they are simple, shop-made tools. Before a templet for end-welded studs is designed, five important factors must be considered: (1) accuracy required, (2) number of pieces to be welded, (3) type of stud involved, (4) size and nature of work, (5) allowable tooling costs.

In some instances, a center-punch mark is all that is required to locate the stud properly. However, most uses in metalworking require greater dimensional accuracies than can be achieved by this simple method.

Templets may be constructed from steel plate, ebonite or masonite sheet, or may consist of specially fabricated inserts. In general, holes are drilled in the templet large enough to accommodate the ceramic ferrule which surrounds the stud. Thus, the stud is located by the ferrule.

Positioning the templet over the work may be accomplished by several methods. Pins on the templet, located so they enter existing holes in the work, will do the trick. Small plates or bars welded to the templet so they contact the sides or edges of the work are often used. While each has proved satisfactory in actual practice, almost every application requires special consideration, although one of these two basic methods can usually be used.

This method of stud location does not insure proper angular alignment of the stud with the work; it is the responsibility of the operator to hold the gun perpendicular to the work.

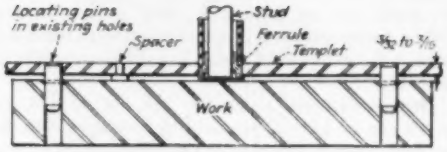
Some degree of alignment is achieved when the plastic ferrule tube is firmly positioned over the ferrule itself. In many cases, this factor, plus reasonable care on the part of the operator, will result in welds of sufficient accuracy.

Typical applications for this type of templet include: transformer cases, water-heater tanks, and crankcases for diesel motors.

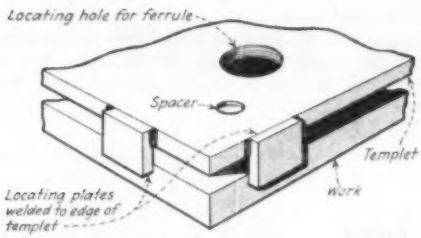
Standard Nelson MG studs have a reduced base which produces a weld fillet only slightly larger than the OD of the threaded portion of the stud. The ferrule commonly used with these differs from ferrules used with other types in that it is considerably shorter. Templets designed for such studs may rest on the shoulder of the ferrule. In this case, the ferrule does double duty—acting as a locating device for the stud and providing the necessary venting space between templet and work. Here again accuracies of 1/32 in. are obtainable, and the same general restrictions about perpendicular welds also apply. Welding studs to large fabricated vent valves is a typical application where this type of templet has proved successful.

Where perpendicularity of the studs is important, templets may be modified to provide greater bearing surface. If solid or laminated ebonite or masonite is used, this should be at least ¾ in. thick and separated from the work by spacers at least 5/16 in. high. For repetitive work, holes should be bushed and should be a good fit on the ferrule tube of the welding gun. The tube positions the ferrule within the templet, thus locating the stud within dimensional accuracies of 0.010 in., and insuring its attachment in a vertical position.

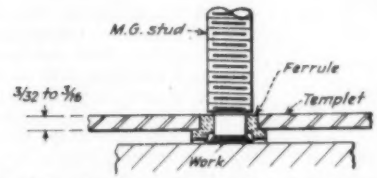
A similar effect can be obtained with a steel tem-



Simple sheet-metal templet has pins fitting into holes in the work, and has holes bored to fit ferrules at required locations. Spacers must raise templet at least 1/16 in. for venting



Edge locators may be used when pin holes are not available. Accuracy of 1/32 in. in stud location can be obtained with simple templets of this type, but angular alignment depends on operator's skill

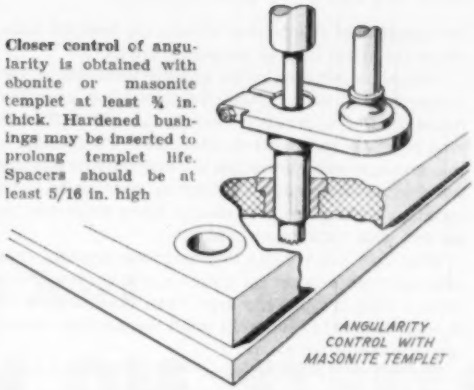


Reduced-base studs, type MG, require a short ferrule, and templets for this style may be designed to rest on the ferrule shoulder which thus locates the stud and provides vent space for gases

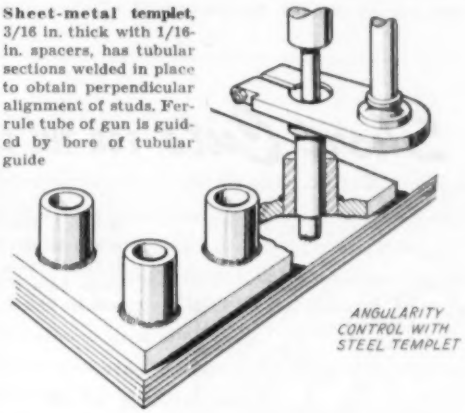
plet about 3/16 in. thick, by welding or silver-brazing short sections of tubing at the desired locations, and using these to guide the ferrule tube. It is advisable to attach the guides first, then bore the tube and templet together to proper diameter. With metal templets, a 1/16-in. spacer is adequate for venting.

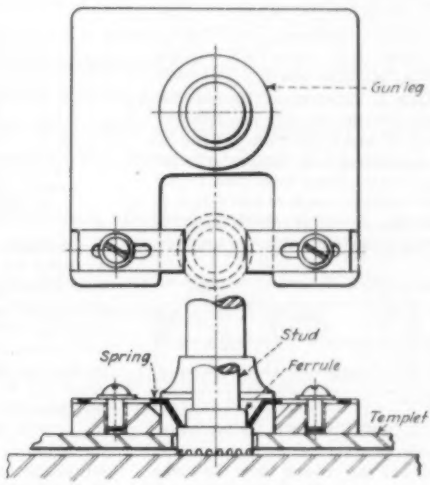
Simple templets shown in the first illustrations are most commonly used and are least expensive, although they offer the disadvantage of providing no means of keeping the stud perpendicular. This trouble can be overcome by use of an adapter plate about 2½ in. square and 5/16 in. thick. It is supported by the quick-adjustable leg of the gun, and rests on the templet. One edge is cut out to clear all sizes of ferrules, and grooves are cut to accommodate two leaf springs. Springs have elongated holes to permit adjustment for various sizes of ferrules, and press against the ferrule shoulder to hold it firmly against the work. The stud is located, as before, by

Closer control of angularity is obtained with ebonite or masonite templet at least ¾ in. thick. Hardened bushings may be inserted to prolong templet life. Spacers should be at least 5/16 in. high



Sheet-metal templet, 3/16 in. thick with 1/16-in. spacers, has tubular sections welded in place to obtain perpendicular alignment of studs. Ferrule tube of gun is guided by bore of tubular guide





Baseplate attached to leg of gun provides a simple means of keeping the stud in a vertical position. Cutout is large enough to clear any size ferrule. Springs are adjustable to fit ferrule being used

the position of the ferrule within the templet hole, while the plate insures perpendicularity.

This plate, which can be quickly adjusted to the proper height, may replace the tripod-leg assembly formerly used to obtain perpendicular welds. Plunge may be easily increased or decreased. Furthermore, this arrangement eliminates the necessity of passing the stud down through a plastic or metal tube, thus speeding loading and positioning. Short studs may be welded with little or no difficulty.

Whenever the volume of production permits, it is often advisable to set up a permanent stud-welding fixture. This is especially true when the studs are to be end-welded to relatively small components which can be handled with ease.

Under these circumstances, the problem of templeting becomes one of locating and clamping the work in a fixture rather than positioning the gun. As gun position is fixed, the purpose of a fixture is to establish the work in correct relationship to the gun so studs will be welded in their proper location. When constructed with reasonable care, fixtures used with production units make accuracies of 0.010 in. possible.

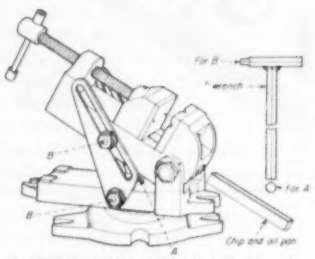
Where extreme accuracies are not needed, flat work can be located properly by a fixture with two or more positioning pins or edge plates.

When studs are to be welded to curved surfaces, the templets often assume a cradle-like appearance, with stops added to insure proper angular position of the studs.

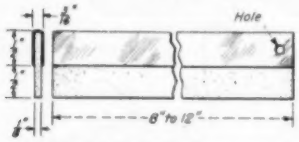
Regardless of the application involved, it is possible to develop some type of locating fixture, either for the stud-welding gun or for the work. Careful planning and imagination on the part of production men can result in simple, yet effective templets which will guarantee proper accuracy and speed production.

Short Cuts FOR THE SMALL SHOP

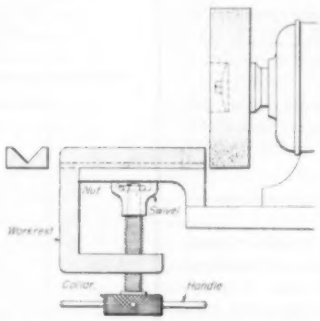
BY CHARLES L. LEEPER



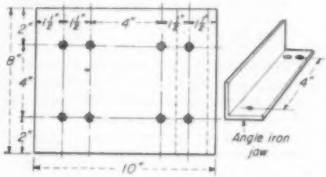
A CHIP AND OIL PAN for the milling-machine vise is a great convenience. This pan slips into the guide for the movable jaw and prevents oil and chips from getting into socket-screw *A*, which locks the vise to the swivel base. The T-handle wrench is made to suit screw *A*; also the screws *B* which lock the tilting arms to the vise and the base.



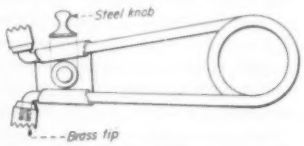
A LEATHER WIPER for the bench is not affected by oil, chips or dirt and will last a long time. To make one, take an old windshield wiper and pry the metal channel off the old rubber insert. Fit a strip of leather ⅛-in. wide and of suitable length to the channel and close the metal firmly onto the leather. Felt is too flexible for this purpose and chips adhere to it; rubber is soon ruined by oil.



A QUICKLY DEMOUNTABLE workrest for grinding the ends of workpieces square consists of a few simple parts. The body is made by forming a piece of rectangular stock to U shape and cutting a V-groove in the top face. Drill and tap the other leg for a clamp screw that terminates in a swivel foot for bearing against the regular workrest of the grinder. Fasten a knurled collar to the other end of the screw. If the collar is made hollow, as shown, drill cross holes to receive a handle. And put a snug-fitting keeper spring on the handle.



A JOB for clamping straight or tapered rounds on the drill press is made up thus: Drill and tap eight holes in a baseplate 8x10 in. Make up two angle-iron clamping jaws: drill one hole off center in one leg of the angle, and make the hole a loose fit for a capscrew. At other end of leg, 4 in. away, drill two elongated holes, so that the face of the angle iron can be set to any taper likely on the work. Use capscrews that are flush with the bottom of the baseplate, when fastening the angle-iron clamps.



SPINDLE THREADS are readily cleaned with this device. The spring portion might be made from an old anti-shimmy attachment as used on automobiles. Heat and bend the ends. Thread to screw on the brass cleaning tips. Make a slider of sheet aluminum and form around the spring arms. This slider can be positioned to close the arms to release the tool, or moved left so the tips apply pressure to the spindle threads while cleaning them.

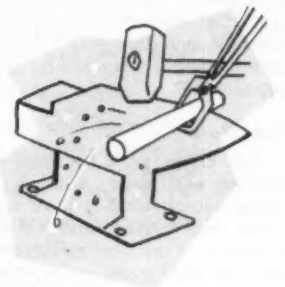
SELECTION

How to Work

TOOL and DIE STEELS

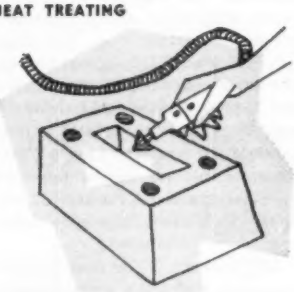
PART..1

BY ANDERSON ASHBURN, ASSOCIATE EDITOR



FORGING

HEAT TREATING



MACHINING

PROPER selection and use of tool and die steels is a basic requirement of nearly all metalworking operations. Unless the right steel is selected for a particular job and it is properly prepared for use, there may be waste of the tool steel (which is expensive), of the time spent in sinking dies or making tools, of the setup time on the machine, of the time required for the operation, or of all of these.

Proper selection of tool and die steels is complicated by their many special properties. The five principal ones are:

1. Heat resistance, 2. Abrasion resistance, 3. Shock resistance, 4. Resistance to movement or distortion in hardening, and 5. Cutting ability.

Because no one steel can develop all of these qualities to the maximum, or include all the other qualities that may be required, hundreds of different tool steels have been developed. In addition to variations in chemical composition, there are many proprietary variations in methods of production which further complicate the problems of the user of tool and die steels.

This report is in two parts. The first part deals with the problems of classification and selection of a group of basic tool and die steels which will fill most of the requirements of Metalworking. It also covers the heat treating, forging, and machining of these steels.

The second part will translate these basic steels into specific brands and also cover the many special tool and die steels outside the basic group including characteristics, source, and other data.

A SPECIAL American Machinist REPORT TO THE METALWORKING INDUSTRIES

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Classification and Properties

MANY attempts have been made to bring order and simplification out of the hundreds of tool and die steels that have been developed. There are probably as many systems of classification as there are steels.

The tool steel committee of the American Iron and Steel Institute has worked on the problem for several years and has developed a tentative standard recently published by the Society of Automotive Engineers. This standard has been widely applauded and is the basis of classification used here. It includes 33 steels divided into 6 groups.

The beginnings of order came when the Gorham Tool Co. assigned a logical system of code numbers to high-speed steels. This basic method has been followed by the Joint Industry Committee in standardizing these steels for the automotive industry.

JIC numbers have been assigned to all of the steels in the SAE tentative standard except three cobalt-bearing high-speed steels. In addition JIC has listed nine steels not included in the SAE standard (they are O-4, S-3, S-4, H-3, H-4, P-1, P-2, P-3, P-4). The steels in the new standard plus H-3 and H-4 (die-block steels are not covered by the SAE standard) are listed in the table on the facing page. The remainder of this section describes the general characteristics of each of the groups and of the alloying elements used in tool and die steels.

Water Hardening

This group includes the plain carbon and the carbon-vanadium tool steels. The carbon steels were the original tool steels. Development of the high-speed and alloy tool steels has meant their replacement in many specialized applications. However, because of their low cost, abrasion-resisting and shock-resisting qualities combined with ease of machinability and ability to take a keen cutting edge, the carbon grades still have the widest field of application.

The 0.80 carbon steel (W-8) is best for tools subject to shock, the 1.00 carbon steel (W-10) is the general-purpose tool and die steel in widest use, and the 1.20 carbon steel (W-12) provides maximum abrasion resistance and keenest cutting edge on tools.

The carbon-vanadium steels are shallower hardening and allow a wider range of hardening temperature without increase in grain size (which would cut toughness).

Water-hardening tool steels should not be used:

1. Where maximum safety in hardening is desired
2. In applications requiring maximum shock resistance
3. Where maximum abrasion resistance is required
4. Where tools or dies operate substantially above room temperature
5. Where tool or die must have high hardness all the way through.

Oil Hardening

This group was developed for maximum safety in hardening and minimum dimensional change after heat treatment. They are preferred, therefore, for tools or dies with adjacent thin and thick sections, sharp corners, or numerous holes. They have better wear resistance than the water-hardening grades but are not quite as good in shock resistance. (An exception is a higher-nickel steel not included in the standard that has about the same toughness as S-2, but with sacrifice of wear resistance.) Machining properties are good and material cost is relatively low, but they are not applicable to use at elevated temperatures.

Air Hardening

Even safer hardening is provided by this group than with the oil-hardening steels. In addition they provide more wear resistance in general, but at a loss of shock resistance. More costly than oil-hardening steels, they are sometimes employed for hot work (such as bending dies) where wear resistance is of greater importance than heat resistance.

Shock Resisting

This group was developed for resistance to shock in cold-battering operations and where abrasion resistance is of secondary importance. The chromium-tungsten steel (S-1) has some hot-work properties and can be used for hot-shearing and drop-hammer dies with operating temperatures from 500 to 800 F.

Hot Work

This group must combine red hardness with wear resistance and shock resistance. They have relatively low carbon and smaller quantities of the alloying elements than do high-speed steels. Their applications include header dies, gripper dies, extrusion dies, permanent-mold and die-casting dies, hot punches, shear blades, and trim dies. The low-alloy, medium-carbon forging die blocks are included in this group by JIC (but not by SAE).

High Speed

High-speed steels, development of which began in 1900, were developed primarily to provide red hardness and high abrasion resistance with some shock resistance for use in cutting tools. The original HSS was 18% tungsten and 4% chromium developed by Taylor and White. Mathews added the 1% vanadium three years later to form the familiar tungsten 18-4-1 (T-1) which is still the most widely used high-speed steel. A number of other tungsten steels have been developed.

More recent is the molybdenum group, of which the molybdenum-tungsten 6-6-2 (M-2) is a typical example. These have equivalent qualities and are cheaper, but require more care in heat treatment and have a greater tendency to de-

APPROXIMATE COMPOSITIONS OF TOOL AND DIE STEELS

CLASSIFICATION	JIC No.	Carbon C	Manganese Mn	Silicon Si	Chromium Cr	Vanadium V	Tungsten W	Molybdenum Mo	Cobalt Co	Nickel Ni
WATER-HARDENING TOOL STEELS										
.80 Carbon	W-8	.70–.85	Note[2]	Note[2]	Note[2]	.....	.....	.....	.....	.....
.90 Carbon	W-9	.85–.95	Note[2]	Note[2]	Note[2]	.....	.....	.....	.....	.....
1.00 Carbon	W-10	.95–1.10	Note[2]	Note[2]	Note[2]	.....	.....	.....	.....	.....
1.20 Carbon	W-12	1.10–1.30	Note[2]	Note[2]	Note[2]	.....	.....	.....	.....	.....
.90 Carbon-V	W-9V	.85–.95	Note[2]	Note[2]	Note[2]	.15–.35	.....	.....	.....	.....
1.00 Carbon-V	W-10V	.95–1.10	Note[2]	Note[2]	Note[2]	.15–.35	.....	.....	.....	.....
1.00 Carbon-VV	W-10VV	.90–1.10	Note[2]	Note[2]	Note[2]	.35–.50	.....	.....	.....	.....
OIL-HARDENING TOOL STEELS										
Low Manganese	O-1	.90	1.20	.25	.50	.20[1]	.50	.....	.....	.....
High Manganese	O-2	.90	1.60	.25	.35[1]	.20[1]	.....	.30[1]	.....	.....
High Carbon-High Chromium	O-5	2.15	.35	.35	12.00	.80[1]	.75[1]	.80[1]	.....	.50[1]
Chromium	O-3	1.00	.35	.25	1.40	.....	.....	.40	.....	.....
Molybdenum Graphitic	O-6	1.45	.65	1.00	.....	.....	.....	.25	.....	.....
AIR-HARDENING TOOL STEELS										
High Carbon-High Chromium	A-1	1.50	.40	.40	12.00	.80[1]	.....	.90	.60[1]	.....
5 Per Cent Chromium Air Hard.	A-2	1.00	.60	.25	5.25	.40[1]	.....	1.10	.....	.....
High Carbon-High Chrome-Cobalt	A-3	1.50	.40	.40	12.00	.80[1]	.....	.90	3.10	.....
SHOCK-RESISTING TOOL STEELS										
Chromium-Tungsten	S-1	.50	.25	.35	1.40	.20	2.25	.40[1]	.....	.....
Silicon-Moly	S-2	.50	.40	1.00	.....	.25[1]	.....	.50	.....	.....
Silicon-Manganese	S-5	.55	.80	2.00	.30[1]	.25[1]	.....	.40[1]	.....	.....
HOT-WORK TOOL STEELS										
Chrome-Moly-Tungsten	H-1	.35	.30	1.00	5.00	.25[1]	1.25	1.50	.....	.....
Chrome-Moly-V	H-5	.35	.30	1.00	5.00	.40	.....	1.50	.....	.....
Chrome-Moly-VV	H-6	.35	.30	1.00	5.00	.90	.....	1.50	.....	.....
Tungsten	H-2	.32	.30	.20	3.25	.40	9.00	.....	.....	.....
Chrome-Nickel	H-4	.50	.55	.30	.70	.....	.....	.....	.....	1.60
Chrome-Nickel-Moly	H-3	.55	.55	.25	.75	.....	.....	.75	.....	1.60
HIGH-SPEED TOOL STEELS										
Tungsten, 18-4-1	T-1	.70	.30	.30	4.10	1.10	18.00	.....	.....	.....
Tungsten, 18-4-2	T-2	.80	.30	.30	4.10	2.10	18.50	.80	.....	.....
Tungsten, 18-4-3	T-3	1.05	.30	.30	4.10	3.25	18.50	.70	.....	.....
Cobalt-Tungsten, 14-4-2-5	T-8[3]	.80	.30	.30	4.10	2.00	14.00	.80	5.00	.....
Cobalt-Tungsten, 18-4-1-5	T-16[4]	.75	.30	.30	4.10	1.00	18.00	.80	5.00	.....
Cobalt-Tungsten, 18-4-2-8	T-5	.80	.30	.30	4.10	1.75	18.50	.80	8.00	.....
Cobalt-Tungsten, 18-4-2-12	T-6[3]	.80	.30	.30	4.10	1.75	20.00	.80	12.00	.....
Molybdenum, 8-2-1	M-1	.80	.30	.30	4.00	1.15	1.50	8.50	.....	.....
Molybdenum-Tungsten, 6-6-2	M-2	.83	.30	.30	4.10	1.90	6.25	5.00	.....	.....
Molybdenum-Tungsten, 6-6-3	M-3	1.15	.30	.30	4.10	3.25	5.75	5.25	.....	.....
Cobalt-Moly-Tungsten, 6-6-2-8	M-36	.85	.30	.30	4.10	2.00	6.00	5.00	8.00	.....

[1]Optional element. Steels have found satisfactory application either with or without the element present. In the case of silicon-manganese steel listed under shock resisting tool steels, if chrome vanadium and molybdenum are not present, then hardenability will be affected.
[2]Carbon Tool Steels are normally supplied in four grades of quality which are Special, Extra, Standard and Commercial. On Special and Extra grades, limits on manganese, silicon and chromium are not generally required in lieu of the following Shepherd hardenability limits:

.70–.85 C and .85–.95 C			.95–1.10 C and 1.10–1.30 C		
	Penetration	*Fracture Grain Size*		*Penetration*	*Fracture Grain Size*
Shallow	10 max.	8 min.	Shallow	8 max.	9 min.
Regular	9 to 13	8 min.	Regular	7 to 11	9 min.
Deep	12 min.	8 min.	Deep	10 to 16	8 min.

On Standard and Commercial grades, the following limits on composition are generally required:

	Mn	Si	Cr
Standard	.35 max.	.35 max.	.15 max.
Commercial	.35 max.	.35 max.	.20 max.

Total of manganese, silicon and chromium not to exceed .75 per cent.
[3]No JIC number for this steel. This is the number assigned by Gorham Tool Co.
[4]No JIC or Gorham number for this steel. This number has been arbitrarily selected not to conflict with current JIC and Gorham numbers.

carburize. These are not serious objections if modern equipment is available.

Cobalt-bearing steels have been developed in both the tungsten and molybdenum groups. These have higher red hardness with the usual loss of other properties.

Alloying Elements

Carbon—Purpose of carbon is to add to hardness and wear resistance. As carbon is added, up to about 0.85%, capacity of the steel to harden is increased. Adding more carbon does not materially increase the hardness, but it does increase wear resistance. Carbide segregation occurs in varying degree in the more highly alloyed steels and may cause tool failure or difficulty in machining. There is less difficulty with carbide segregation in low-alloy and carbon tool steel.

Manganese — All tool and die steels contain small quantities of manganese. It is not considered an alloying element until present in amounts above 0.60 to 0.80%. Manganese counteracts the brittleness caused by sulfur and makes the steel easier to forge. As an alloying addition it provides an inexpensive method of increasing hardenability. It causes the steel to harden rapidly so that steels with alloying percentages of manganese should be oil quenched.

Silicon — Small percentages of silicon, usually from 0.15 to 0.35%, are added to all tool steels as a deoxidizer and to make them easier to hot forge and roll. For alloying purposes, silicon may range up to 2% or higher. In combination with molybdenum, manganese, or chromium it increases the strength and toughness of shock tools. Care must be taken in hardening and forging to avoid decarburization of high-silicon steels.

Chromium—Chromium is added to tool steels in amounts up to about 12% to increase hardening characteristics. In combination with high carbon it contributes wear resistance and toughness. Its tendency to form carbides is greater than manganese, but less than tungsten. Low- and medium-chromium steels will frequently change size in hardening even more than plain carbon steels. Chromium raises the hardening temperature.

Vanadium — Small amounts of vanadium are added to refine the carbide structure of tool steel, which otherwise is difficult to break up during hot working. In larger amounts, up to about 4%, it increases the red hardness of the steel. Vanadium has a very strong tendency to form carbides.

Tungsten—Tungsten alloys with iron in all proportions enabling it to resist the effects of high temperature and forming hard, abrasion-resisting carbides. Tungsten is used in all high-speed steels in the United States, although it is possible to produce these steels without tungsten at some sacrifice of cutting efficiency. Tungsten enables steels to resist the softening that takes place during tempering. For this reason it is sometimes included in hot-work steels.

Molybdenum — Molybdenum contributes to deep hardening, being second only to carbon in this respect. It raises the resistance to elevated temperatures, and in amounts between 0.25 and 1.50% it increases toughness. In some high-speed steels, molybdenum replaces part of the tungsten.

Cobalt—Cobalt is added, usually to high-speed steels, to increase red hardness. This permits cutting tools to operate at higher speeds. Cobalt raises the temperature necessary for hardening, increases surface decarburization, and decreases toughness.

Nickel—Nickel has little effect on the hardenability of tool steel, but it does add to the toughness and possibly to the wear resistance when used with a hardening alloy such as chromium.

Selecting a Steel

THE BASIC principles involved in selecting a tool or die steel can be rather easily learned. But the job of applying these principles to a particular operation develops into a complex one requiring skill and experience.

Considerable effort has been put into the development of charts and lists of operations designed to aid in intelligent selection. These are available from the various producers of the steels. Such lists, however, must be exceedingly detailed and often recommend several steels for each operation.

Rather than include such a list here, the table on the facing page gives an approximate rating to each of the basic characteristics involved in selection except cost. Cost varies from about 25 cents a pound to more than $1.50 a pound, so this factor should not be overlooked.

Basic Characteristics

Non-Deforming Properties — This column in the table refers to the distortion normally obtained in quenching from the hardening temperature normally employed. The steels rated above 75 can be machined close to size before hardening. The water-hardening steels distort the most, except that when the depth of case is slight in comparison with the core in a particular design, there will be little distortion.

Safety in Hardening—The major point here is freedom from cracking in hardening intricate sections. But in general it refers to freedom from difficulties in the heat-treating operation.

Toughness—The ability to resist the softening effect of heat is important in tools intended for hot work. It varies directly with the content of alloying elements that form hard, stable carbides.

Wear Resistance—The resistance to wear or abrasion varies with the alloy content as indicated in the table. It also varies markedly with the hardness of a given steel. Thus wear resistance can be increased, in general, by operating at the upper end of the hardness range

APPROXIMATE METALLURGICAL CHARACTERISTICS FOR SELECTING TOOL STEELS

CLASSIFICATION	JIC Number	Non-Deforming Properties	Safety in Hardening	Toughness	Red Hardness	Wear Resistance	Cutting Ability	Machinability, Annealed	Resistance to Decarburization	Depth of Hardness	Hardness, Rockwell C
WATER-HARDENING TOOL STEELS											
0.80 Carbon	W-8	20	D	60	20	20	20	A	A	Shallow	56–65
0.90 Carbon	W-9	20	D	58	20	22	24	A	A	Shallow	56–65
1.00 Carbon	W-10	20	D	57	20	25	25	A	A	Shallow	56–65
1.20 Carbon	W-12	20	D	54	20	27	28	A	A	Shallow	56–65
0.90 Carbon-V	W-9V	20	D	60	20	25	23	A	A	Shallow	56–65
1.00 Carbon-V	W-10V	20	D	59	20	27	25	A	A	Shallow	56–65
1.00 Carbon-VV	W-10VV	20	D	65	20	30	25	A	A	Shallow	56–65
OIL-HARDENING TOOL STEELS											
Low Manganese	O-1	86	B	30	25	30	33	C	C	Medium	60–63
High Manganese	O-2	90	B	37	28	32	33	C	C	Medium	58–62
High Carbon-High Chromium	O-5	81	B	10	52	90	52	E	D	Deep	55–63
Chromium	O-3	87	C	32	30	32	33	C	C	Medium	57–65
Molybdenum Graphitic	O-6	81	B	35	28	60	27	B	C		50–64
AIR-HARDENING TOOL STEELS											
High Carbon-High Chromium	A-1	78	A	10	50	85	40	E	D	Deep	57–62
5% Chromium Air Hard	A-2	78	A	20	45	68	34	D	D+	Deep	58–62
High Carbon-High Chrome-Cobalt	A-3	78	A	13	50	85	40	E	D	Deep	60–62
SHOCK-RESISTING TOOL STEELS											
Chromium-Tungsten	S-1	42	C	82	35	21	22	D	D+	Medium	55–58
Silicon-Moly	S-2	42	O-C W-E	90	25	21	22	D	E	Medium	50–60
Silicon-Manganese	S-5	42	O-C W-E	88	28	21	22	D	E	Medium	55–59
HOT-WORK TOOL STEELS											
Chrome-Moly-Tungsten	H-1	30	C	50	60	60	10	D	D	Deep	45–55
Chrome-Moly-V	H-5	30	C	50	60	60	10	D+	D	Deep	45–55
Chrome-Moly-VV	H-6	30	C	50	60	62	10	D+	D	Deep	48–52
Tungsten	H-2	30	C	40	72	50	10	D	D	Deep	40–53
HIGH-SPEED TOOL STEELS											
Tungsten, 18-4-1	T-1	30	C	25	72	75	63	D	C	Deep	62–65
Tungsten, 18-4-2	T-2	30	C	15	75	87	78	D	C	Deep	63–65
Tungsten, 18-4-3	T-3	30	C	10	78	102	95	D	C	Deep	64–66
Cobalt-Tungsten, 14-4-2-5	T-8*	30	D	14	85	90	85	D	E	Deep	64–66
Cobalt-Tungsten, 18-4-1-5	T-16*	30	D	20	88	77	76	D	E	Deep	64–66
Cobalt-Tungsten, 18-4-2-8	T-5	30	D	8	92	84	96	D	E	Deep	64–66
Cobalt-Tungsten, 18-4-2-12	T-6*	30	D	4	103	86	98	D	E	Deep	64–66
Molybdenum, 8-2-1	M-1	30	D	35	72	78	68	D	E	Deep	63–65
Molybdenum-Tungsten, 6-6-2	M-2	30	D	35	76	78	68	D	E	Deep	63–67
Molybdenum-Tungsten, 6-6-3	M-3	30	D	29	79	90	79	D	E	Deep	65–66
Cobalt-Moly-Tungsten, 6-6-2-8	M-36	30	D	17	91	88	96	D	E	Deep	64–65

*Not JIC code numbers. T-6 and T-8 are Gorham, T-16 is American Machinist.
LETTER CODE: A—best, B—very good, C—good, D—fair, E—poor; O—oil quenched, W—water quenched.
NUMBER CODE: Higher numbers represent better characteristics.

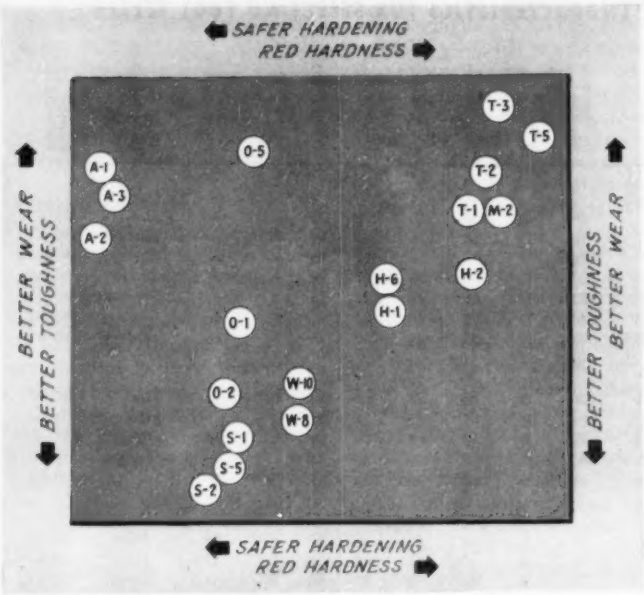
when other factors will permit.

Cutting Ability—This is, in reality, a combination of several of the other characteristics. A direct rating of the ability of the steel to hold a keen cutting edge is useful, however, in selecting steels for cutting tools.

Machinability—Many ratings of machinability exist in percentage terms. The available data differ so widely for a given tool steel, and vary so much with changes in hardness and variations in composition from the nominal, that no direct percentages are given in the table. The letter code gives a truer indication of the relative machinability of these steels.

Resistance to Decarburization—This factor influences the type of heat-treating equipment required and the amount of material that has to be removed after hardening. Those steels rated *E* (poor) should be protected from decarburization during the heating cycle.

Depth of Hardness — Steels quenched in water generally have a shallow case over a soft core.



Initial selection of tool steels can be made from this chart. More exact data are on preceding page

When high strength is required all the way through a large section, a steel with deep-hardening characteristics should be selected.

Hardness—The Rockwell C range indicates the normal hardness that can be obtained through the tempering range of the steel.

Combined Characteristics

To some extent the desirable characteristics of tool steels are mutually opposed. Of the four principle ones, toughness goes up as wear resistance goes down, red hardness goes up as safe hardness goes down, and vice versa. This is not completely true because by alloy combinations it is possible to increase both toughness and wear resistance, for example, though usually at a loss in some other characteristic.

The chart shows roughly the relationship of a number of widely used tool steels in relation to these four factors. It is impossible to position each steel accurately in relation to every other because the factors do not always vary directly. Even so this chart should help in learning the general relationships of the steels and in simplifying the first steps in selection. When it is necessary to move into other areas of the chart, steels not in the standard group covered here may be found to fill the requirements.

Steps in Selection

In selecting a steel, the starting point is always a plain carbon steel such as W-10. This group is the cheapest and easiest to machine so should be selected when it will meet requirements. If slightly deeper hardness penetration is required, go to a lower carbon steel such as W-9. If shallower hardness penetration or finer grain structure are required, go to a carbon-vanadium steel such as W-10V.

Check the metallurgical characteristics of the carbon steels in the table. If they are inadequate for the job, return to the chart and move in the desired direction. After selecting a steel in the required area, check the table to see if it will meet all the requirements. The metallurgical characteristics must be examined in the light of the requirements of the job, the quantity to be produced, and the relative cost of the steels.

If none of these steels seem quite right, it is advisable to consult with one or more steel producers. They may be able to advise a special steel that will fit the particular requirements.

The average plant can simplify its tool steel problems by settling on a few steels as standard. These will prove adequate for nearly all jobs. The resulting simplicity in ordering, stocking, and selecting steels will generally offset the disadvantage that for some operations a non-standard steel might be slightly more efficient.

Forging

ALL TOOL steels have some tendency to decarburize when heated, though this trait is much stronger in the alloy steels than in the carbon steels. Tool steels should be heated, therefore, under accurately controlled temperature and atmosphere conditions. Regular furnaces are all right if the parts are packed in containers with a protective material.

Heating Precautions

Molybdenum high-speed steels are coated with borax to prevent decarburization. They can be sprinkled with or rolled in borax powder after heating to 1300-1500 F, or dipped hot or cold into borax solution at 180 F. Dipping is preferable because only a light coat is required. If reheating is necessary, the blank should be recoated.

Tool steels must be heated slowly and uniformly to permit the heat to penetrate to the center of the piece. Preheating is desirable.

A preheat furnace reduces the danger of rupture through rapid initial heating, decreases the time the work must be held at the high temperature. Decarburization and grain growth are reduced.

If preheating is not possible (and in winter even when it is) it is desirable to knock the chill off the steel before putting it in the furnace. This can be done by placing it on or near the furnace or in a hot-water bath.

Work should generally be soaked at the forging temperature for about 15 min for each inch of thickness. This should be increased to about 20 min for high-chromium steels. But do not hold at forging temperature longer than this and do not let the work overheat.

Forging Practice

Most tool-steel forging is done in open dies. Forging should start with light blows which can be increased after metal begins to flow. Corners should be knocked down before striking a flat section.

All reduction in cross-section is made by going from a square section to a square section. When other shapes are desired, make the reduction in section first, then form the round or other shape. Rounds should be forged in V-dies to prevent center ruptures.

When tool blanks are to be forged in impression dies, they should first be forged to approximate shape in open dies. The high-speed steels especially resist plastic flow and have a tendency to burst.

The chance of hammer bursts is reduced if the billet length is at least twice the billet thickness. If the shape is likely to cause difficulty, it is safer not to saw the blank, but to heat and part it with a hack.

Cobalt steels require special care in forging. They crack easily if the temperature is too low. But with all tool steels it is important to keep within the forging range. The operator must watch the work closely and stop forging promptly at the lower limit. All the steels can be reheated as often as required to complete the operation.

Cooling

All tool steels have some air-hardening properties and should be cooled slowly after forging to prevent cracking from forging strains. This is less necessary for carbon steels, but even they do better with slow cooling. Forgings should be buried in dry ashes, lime, mica, Silocel, or some other retardant material.

In forging tool or cutter blanks, it is customary to leave a ⅛ in. allowance for machining.

Heat Treating

NORMALIZING after forging is advisable for steels that do not have strong air-hardening tendencies. It results in more uniform structure and grain size. The work is heated slowly (see heating precautions) to about 100 F above the critical temperature and held long enough to reach a uniform temperature through the piece. Prolonged soaking is undesirable.

After heating, the work is removed from the furnace and cooled in still air. Normalizing should always be followed by annealing.

Oil Quench Before Anneal

Carbon and carbon-vanadium tool steels with more than 1.10 carbon and size over 2 in. are generally oil quenched rather than normalized before annealing. The work is heated as for normalizing, then quenched in oil rather than cooled in air. This promotes the formation of a spheroidized structure upon annealing.

Annealing

Tool steels are normally purchased already annealed. But if they have been forged or hardened they must be annealed before further heat treatment. They should be annealed in controlled atmospheres or packed in sealed containers filled with cast-iron chips, lime, mica, or other neutral material. The work must not be in contact with the container. When packing the work in cast-iron chips, wrapping it in brown paper will keep the chips from sticking.

Heat slowly and uniformly to the temperature (see Table). Hold at this temperature long enough for complete penetration and transformation, generally 1 to 4 hr.

Cool slowly, preferably in the furnace, down to 1000 F. Proper cooling rates range from 10 to 50 F per hour, with the slower rates being required for higher alloy content. Below 1000 F the cooling rate can be a little faster.

Stress Relieving

After heavy machining or any cold working of annealed tool steels, they should be stress relieved before hardening. This is done by heating to about 1200 F and cooling slowly. Any change in dimensions should be corrected by further machining before hardening. To hold warpage in hardening to a minimum, stress-relieve between rough and finish machining.

Hardening

The rate of heating for hardening should be slower for alloy steels than for plain carbon steels. The higher the alloy content, the slower the heating rate should be. Much difficulty with warping or size change can be reduced or eliminated by slow, uniform heating.

Molten baths provide the fastest method for heating. Open or semi-muffle fuel-fired furnaces are slower. Electric or complete muffle furnaces are slowest of all.

The steel should be placed on supports to raise it from the furnace floor. The supports should be so placed that the steel will not sag while in the plastic state. Parts that tend to heat non-uniformly should be rotated occasionally.

When heated, tool steel will decarburize if in contact with scale. Therefore, steel, furnace hearth, containers, and supports must be kept as free from scale as possible.

FORGING AND HEAT TREATING OF TOOL AND

	JIC Number	Forging: Heat Slowly to, °F	Forging: Start Forging, °F	Forging: Stop Forging, °F	Forging: Hardness as Rolled or Forged, Brinell	Annealing: Normalize, °F	Annealing: Temperature, °F	Annealing: Annealed hardness, Brinell	Annealing: Preheat Temperature, °F	Annealing: Hardening Temperature, °F
WATER-HARDENING TOOL STEELS										
0.80 Carbon	W-8	1450	1875-1925	1500	275	1500-1600	1400-1450	187	—	1450-1500
0.90 Carbon	W-9	1450	1850-1900	1475	275	1500-1600	1375-1425	187	—	1425-1475
1.00 Carbon	W-10	1450	1850-1875	1475	275	1550-1650	1375-1425	187	—	1375-1450
1.20 Carbon	W-12	1450	1825-1850	1450	275	1550-1650	1375-1425	187	—	1375-1450
0.90 Carbon-V	W-9V	1450	1850-1900	1475	275	1500-1600	1375-1425	187	—	1425-1475
1.00 Carbon-V	W-10V	1450	1850-1875	1475	275	1550-1650	1375-1425	187	—	1400-1450
1.00 Carbon-VV	W-10VV	1450	1850-1875	1475	275	1550-1650	1375-1425	187	—	1400-1450
OIL-HARDENING TOOL STEELS										
Low Manganese	O-1	1500	1800-1950	1500	325	Don't	1400-1450	202	1200	1450-1500
High Manganese	O-2	1500	1800-1900	1550		1500-1550	1375-1425	202	1200	1400-1440
High Carbon-High Chromium	O-5	1500	1900-1950	1700	400	Don't	1600-1650	241	1500	1750-1825
Chromium	O-3	1500	1800-1900	1550		1600-1650	1400-1450		1200	1500-1600
Molybdenum Graphitic	O-6	1500	1950	1500		1650	1450	217		1450-1550
AIR-HARDENING TOOL STEELS										
High Carbon-High Chromium	A-1	1250	1900-2000	1650	550	Don't	1600-1650	241	1225	1800-1850
5% Chromium Air Hard.	A-2	1650	1900-2050	1700	500	Don't	1600-1650	212	1200	1725-1775
High Carbon-High Chrome-Cobalt	A-3	1650	1800-2000	1650		Don't	1625-1650	241	1225	1825-1850
SHOCK-RESISTING TOOL STEELS										
Chromium-Tungsten	S-1	1500	1900-2100	1600	400	Don't	1450-1500	212	1200	1700-1800
Silicon-Moly	S-2	1500	1900-2100	1600		1500-1600	1400-1450			1550-1650
Silicon-Manganese	S-5	1500	1850-1950	1650	350	1500-1600	1400-1450	229		1600-1700
HOT-WORK TOOL STEELS										
Chrome-Moly-Tungsten	H-1	1650	2050-2150	1650	500	Don't	1550-1600	217	1350	1800-1875
Chrome-Moly-V	H-5	1600	2000-2100	1650	500	Don't	1550-1600	217	1350	1825-1875
Chrome-Moly-VV	H-6	1650	2050-2150	1650	500	Don't	1550-1660	217	1350	1825-1875
Tungsten	H-2	1600	1950-2000	1700	500	Don't	1550-1600	229	1500	2050-2150
HIGH-SPEED TOOL STEELS										
Tungsten, 18-4-1	T-1	1600	2000-2150	1700	575	Don't	1600-1650	241	1600	2325-2375
Tungsten, 18-4-2	T-2	1600	2000-2150	1700	575	Don't	1600-1650	241	1600	2325-2375
Tungsten, 18-4-3	T-3	1600	2000-2050	1750	575	Don't	1600-1650	250	1550	2300-2350
Cobalt-Tungsten, 14-4-2-5	T-8*	1600	1900-2100	1700	575	Don't	1600-1650	250	1550	2300-2350
Cobalt-Tungsten, 18-4-1-5	T-16*	1600	2000-2100	1750	575	Don't	1600-1650	255	1550	2350-2400
Cobalt-Tungsten, 18-4-2-8	T-5	1600	1950-2050	1700	575	Don't	1600-1650	255	1550	2350-2400
Cobalt-Tungsten, 18-4-2-12	T-6*	1600	1950-2050	1700	575	Don't	1600-1650	302	1550	2350-2425
Molybdenum, 8-2-1	M-1	1500	1900-1950	1700	575	Don't	1550-1600	241	1550	2175-2240
Molybdenum-Tungsten, 6-6-2	M-2	1500	1900-2100	1700	575	Don't	1600-1625	241	1550	2250-2300
Molybdenum-Tungsten, 6-6-3	M-3	1500	1950-2050	1800	575	Don't	1550-1600	241	1500	2200-2250
Cobalt-Moly-Tungsten, 6-6-2-8	M-36	1500	1950-2050	1800	575	Don't	1550-1600	241	1500	2220-2275

*Not JIC code numbers. T-6 and T-8 are Gorham, T-16 is American Machinist.
QUENCHING MEDIUM: W—water, B—brine, O—oil, A—air.

Large or intricate shapes should always be charged into a furnace below 1000 F. Experiment will determine when small pieces can be charged at higher temperatures.

Preheating is not always necessary for the water-hardening or oil-hardening groups. However, if the furnace does not have controlled atmosphere, preheating will reduce the time in the hardening furnace and reduce scaling and decarburization.

In general, large pieces are heated to the high side of the hardening range and small pieces to the low side. Steel must be held at temperature long enough to insure uniform heating. Quenching when the center is cooler than the surface is likely to cause spalling of the corners. Longer time at temperature is required for the high-alloy steels.

DIE STEELS

Hardening

Quenching Medium	Tempering Temperature, °F	Hardness, Rockwell C
W, B	300-650	56-65
W, B	300-650	56-65
W, B	300-650	56-65
W, B	300-650	56-65
W, B	300-650	56-65
W, B	300-650	56-65
W, B	300-650	56-65
O	350-450	60-63
O	325-475	58-62
O	350-500 800-1000	55-63
O	300-600	57-65
O	300-800	50-64
A	400-900	57-62
A	350-600	58-62
A	450-980	60-62
O	300-500 1000-1200	55-58 45-52
B, W	300-800	50-60
O	400-650	55-59
O, A	1000-1150	45-55
A	1050-1150	45-55
A	1050-1100	48-52
O, A	1100-1250	40-53
O	1025-1100	62-65
O	1025-1100	63-65
O	1020-1050	64-66
O	1050	64-66
O	1000-1100	64-66
O	1050-1100	64-66
O	1050-1100	64-66
O	1000-1050	63-65
O	1000-1075	63-67
O	1020-1080	65-66
O	1020-1080	64-65

The manganese oil-hardening steels (0-1 and 0-2) tend to quench with a soft skin on the surface. A slightly oxidizing atmosphere will prevent this condition. The high-speed and high-chromium steels should be heated in a reducing atmosphere.

When pack hardening, it is advisable to insert a thermocouple in the pack, near to or in contact with the tools. Otherwise it is difficult to estimate the time required.

Higher temperatures than necessary or overlong soaking at hardening temperatures will lead to grief. It causes decarburization, coarse grain structure, and is likely to result in cracking in the quench.

The safest procedure is to make a trial run when working with an unfamiliar tool steel. Nick several small specimens and harden them from a range of temperatures below, at, and above the recommended temperature. Take hardness readings of the test pieces and break them at the nick. Study of the fractures will show which temperature produces the best grain refinement. A combination of this test with the hardness data will make it possible to select the best temperature for hardening.

Quenching Media

Water—Fresh water is generally undesirable because of the air it contains. Water that has been boiled or frequently used for quenching will give better results. Temperature should be 60 to 80 F.

Brine—A more uniform and drastic quench is provided by brine (not over 10% salt by weight) than by water, especially in still or mildly agitated baths. It produces a cleaner, more uniform surface on the tools. Temperature should be 60 to 80 F. Rinse the parts after quenching to avoid corrosion.

Oil—Best results with oil baths are at temperatures from 100 to 150 F. Quenching in cold oil should be avoided. Mineral oils are preferable to animal or vegetable oils. The bath should be checked frequently for the presence of water.

Air—Air hardening can be done in still air, fan air, or a blast of compressed air. Blast air must be applied evenly over the work and must be free of water. The tool should be supported to provide as even cooling as possible.

Sodium Hydroxide—Carbon tool steels may be quenched in 5 to 10% sodium hydroxide. It has a tendency to overcome soft spots, gives a bright finish, and does not corrode the steel. It will irritate the skin and must be handled with care.

Quenching Methods

When work is removed from the furnace and placed in the quench, the formation of gas pockets must be avoided. This can be done by vigorous agitation or by sprays or geysers. The quenching medium must come in contact with all parts of the work (this means the work must not rest on the bottom of the tank).

The work should not be removed from the quench until it is below 200 F (see exceptions below). A good method is to remove it when the surface temperature is 125 to 150 F. If a large mass is involved, place the work in an oil bath until the temperature is equalized through the work.

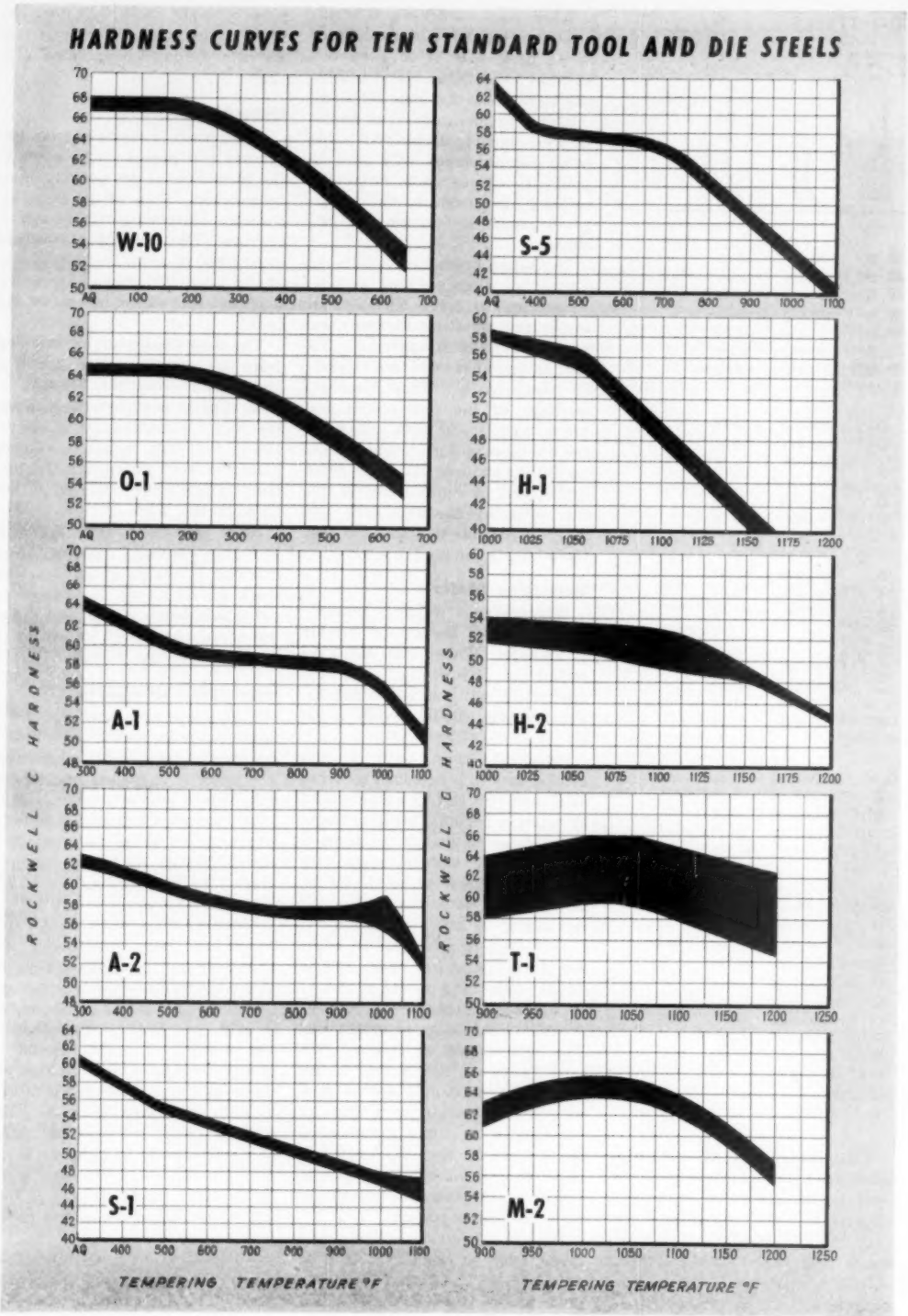
After quenching, the steel is in a highly strained condition and cracking is always imminent. The work should never be allowed to get completely cold at this time, but should be placed immediately in the tempering furnace.

Interrupted Quenching

High-speed and other highly alloyed steels frequently give better results with an interrupted quench. The work is quenched into an oil, salt, or lead bath at 1050 to 1150 F. When the steel has cooled to bath temperatures it is removed and cooled in still air to the temperature (100 to 125 F) at which it is ready for tempering.

Martempering—Oil- and air-hardening tool steels can be quenched into a salt bath slightly above the temperature where martensite begins to form, then cooled in still air. Bath temperature is 400 to 425 F. The bath should be of sufficient size and circulation for the work to reach this temperature in not more than 10 min. This method avoids warpage but must be performed with accurate temperature control if cracking is to be avoided. Martempering is followed by tempering in the usual way.

Austempering—Austempering is a patented method that can be applied to some tools. They are


HARDNESS CURVES FOR TEN STANDARD TOOL AND DIE STEELS
W-10
O-1
A-1
A-2
S-1
S-5
H-1
H-2
T-1
M-2
ROCKWELL C HARDNESS
ROCKWELL C HARDNESS
TEMPERING TEMPERATURE °F
TEMPERING TEMPERATURE °F

NOTES FOR CURVES

W-10 . . . Specimen quenched from 1425 and 1475 F in water or brine.

O-1 . . . Specimen quenched in oil from 1425 and 1450 F.

A-1 . . . Tempering curve was obtained from 1-in. dia x 2-in. specimen held 20 min at 1800 F and quenched in oil then tempered 1½ hr. If air quenched would have been heated to 1850 F for hardening.

A-2 . . . Specimen 4 x 4 in. was air cooled from 1800 and 1850 F. Hardening temperature has marked effect on hardness in tempering from 950 to 1050 F.

S-1 . . . Specimens ½ x ½ x 2 in. were oil quenched from 1700, 1750, and 1800 F. Holding time was 45 min. Tempered for 1 hr.

S-5 . . . Specimens ½ x ½ x 2 in. were oil quenched from 1650 to 1850 F. Holding time was 45 min. Tempered for 1 hr.

H-1 . . . Specimens 2-in. dia x 2 in. were preheated at 1450 F for 60 min held 45 and 30 min at 1550 and 1900 F. Still air cooled at 2 F per sec through 1300 F and tempered 2 hr.

H-2 . . . Specimens 2-in. dia x 2 in. were preheated 60 min at 1550 F. held for 60, 40, and 20 min at 2000, 2050, and 2100 F. Still air cooled at 2 F per sec through 1300F and tempered 2 hr.

T-1 . . . Specimens 1-in. dia x 2 in. were preheated 45 min at 1150 F, second preheat 45 min at 1550 F, then 8.5 min at 2200, 7.8 min at 2300, and 4.5 min at 2400 F (some specimens at each hardening temperature). Oil quenched and double tempered with 2 hr at heat each time.

M-2 . . . Specimens ¾-in. dia x 2¾ in. were preheated at 1450 F, heated in atmosphere-controlled furnace to 2225 F, cooled in oil to 1000 F, air cooled to room temperature. Double tempered, 2 hr at heat each time.

quenched into the low temperature bath which has a rate of heat abstraction high enough to prevent the formation of high-temperature transformation products. It is limited to section sizes smaller than 1 in. and tools which do not require a hardness higher than R. 60.

Tempering

Satisfactory tempering depends on slow, even heating. Liquid baths are generally best—oil at low temperatures and salt or lead for high temperatures. In a liquid, the work should be placed in wire baskets to prevent contact with sides or bottom of the tempering pot. The steel, still warm from hardening, should be charged into the furnace or pot at a low temperature.

Rapid heating will cause warpage. Bring the temperature slowly to the desired level. Time at temperature is of especial importance. At 300F, time should be about 4 hr per inch of section; at 400 F, only about 2 hr is required. In the higher range, above 1000 F, 45 to 60 min per inch is adequate.

Never economize on time at this stage. An extra hour in the tempering bath may avoid breakage of the tool or die. After tempering, the work is removed and cooled in still air.

High-speed and hot-work steels require double tempering. That is, the tempering cycle is repeated twice. Failure to perform this second tempering may cause early failure. Hot-work steels should be tempered about 50 F above their expected operating temperature.

Ring dies are generally flush quenched on the center only and are not tempered because the stresses are in a favorable direction.

Testing

BECAUSE tool steels are a quality material, they are usually governed by rigid specifications. Many companies specify physical, chemical, and metallurgical tolerances when ordering these steels and test the steels upon receipt to see that they conform to specifications.

Surface allowances must be included for decarburization and surface defects in hot-rolled or cold-drawn steels. A typical allowance is:

Dimension, in.	Allowance per side, in.
up to ½	0.016
over ½ to 1	0.031
over 1 to 2	0.047
over 2 to 4	0.063
over 4 to 5	0.078

Centerless ground stock is normally specified to be free of surface defects but an allowance must be made for decarburization. Typical allowance is 0.005 in.

It is also necessary to establish dimensional tolerances when steel is ordered to specified sizes. Ordering is simplified when these and surface allowances are within the limits normally guaranteed by the supplier.

For chemical limits it is necessary to establish a range of composition for each element in the steel. This may be as small as 0.10% for the carbon content of some steels or as much as 2.5 or 3% for the cobalt or tungsten content in some high-speed steels. Analysis of the chemical composition is made after removing the decarburized surface. The sample may represent a complete cross section or be taken parallel to the axis by drilling midway between the center and the surface.

Steel is normally purchased in the annealed condition and a limit on hardness may be included or hardness may be specified to fall within a certain range. Comparative tests on macrostructure, carbide form and distribution, hardenability, and grain structure may be included. Some of the most frequently employed tests are described below.

Grain Size

The fracture method of checking for grain size can be applied to all tool steels. It is made by hardening a notched specimen not more than 1 in. in section. After fracture by pressure or impact, the fractured surface is compared with standard samples such as the Shepherd fracture standards. These are

rated from 1 to 10 with the higher numbers representing finer grains. A typical requirement would call for a grain size no coarser than 8 except on some hot-work steels. High-speed steel requires a finer grain structure.

The intercept method is more suitable for high-speed and high carbon-high chromium steels because it is more sensitive to fine changes in grain structure. The intercept count is the average of the number of grains intercepted by a line 0.005 in. long at ten random points. Numbers above 15 indicate a very fine grain size, 12 to 15 a fine grain size, 9 to 11 a fairly coarse grain size, and 8 and lower a coarse grain size.

In practice, a polished specimen is etched by a 3 to 1 combination of hydrochloric and nitric acids. It is examined at 1000X and the number of grains intercepted by each of ten 5-in. lines is counted and recorded. A typical standard calls for intercept counts from 12 to 16.

Deep Etch Test

Visual examination for seams, surface cracks, internal cracks, pipes, and segregation is made by a deep etch test. A cross section of the steel is machine-finished or rough ground and heated to 160 to 180 F. It is immersed in a 1 to 1 hydrochloric acid bath maintained at the same temperature. Time varies from 30 to 40 min depending on analysis. The time is critical as too light or too deep an etch will not show up details.

Hardenability

Ability of the steel to have a uniform and minimum hardness, and in the case of shallow hardening steels to harden to a certain depth, can be checked in a number of ways. One of the most common for carbon and carbon-vanadium steels is the Penetration-Fracture test. For the P-F test, four specimens are selected, typically ¾-in. dia by 3 in. long. Some firms use specimens 1- to 1½-in. dia with length three times the diameter.

Specimens should be machined to remove all decarburization and should be taken off center from large bars. Outside surface is ground or polished. The four specimens are hand quenched in brine from 1450, 1500, 1550, and 1600 F. Sometimes they are quenched in water with a special fixture.

The specimens are fractured and the grain size of one half checked against Shepherd standards. The other half is ground smooth and parallel to the finished end, then etched in 1 to 1 hydrochloric acid at 180 F. The hard case is clearly defined and can be measured in 64ths of an inch. Care must be taken to prevent tempering in grinding.

Deep hardening steels do not show a clearly defined case. The test can be made of these steels with the larger samples or other tests can be selected.

Microscopic Examination

Polished samples are inspected under the microscope at 100X or more. Unetched specimens are checked for non-metallic inclusions. Careful polishing is required to avoid pits.

Polished and etched specimens are examined for carbide segregation. The extent of segregation is especially important in high-speed and high carbon-high chromium steels. Generally more latitude is required in setting limits on carbide segregation in larger bars than in small ones. A single microscopic examination will not always give a true picture of a bar because the extent of segregation may vary considerably from one end of the bar to the other.

Machining

MACHINING of tool steels is done in the annealed condition whenever possible. However, it is now possible to machine these steels in the fully hardened condition when necessary.

Normally, tool steels are furnished in the annealed condition. If it has been necessary to forge them they should be normalized (when applicable) and annealed before machining is performed. An exception is the medium-carbon, low-alloy die blocks for forging which are generally heat treated prior to machining, and are often purchased in the hardened condition.

In the annealed condition hardness generally ranges from 160 to 250 Brinell. Difficulties arise because the high carbon or alloy content makes them extremely abrasive to the cutting tools. If the hardness is too low, these steels are gummy and tend to tear, causing the tools to dig in and break. This is especially true of the die steels and they are easier to machine at 250 Brinell than at 180.

The high carbon-high chromium steels are the most difficult to machine, with the high-speed steels next. Of the latter, the cobalt grades are the hardest on tools with the straight tungsten grades being slightly harder to machine than are the molybdenum types.

Rough tool marks should be removed before hardening or they may cause cracking. This is especially true of the carbon and carbon-vanadium steels.

Most of the machining is done with Tungsten 18-4-1 high-speed steel. However, straight tungsten carbide grades in the higher hardness range and cast alloys or steel-cutting carbide grades in the medium hardness range are employed. When it is necessary to machine tool steels or die steels for cold work in the fully hardened condition, straight tungsten carbide tools are required.

Machining Allowances

Diameter of Bar, in.	Allowance, in.
1¼ and under	1/16
over 1¼ to 3	1/8
3 to 5	1/4
over 5	3/8

Turning

Usual practice is to run the job fast enough to produce a blue chip. Typical speeds are suggested in

TYPICAL TURNING SPEEDS FOR ANNEALED TOOL STEELS (Sfpm)

Work Material	Tool Material	Cut 0.005 to 1/64 Feed 0.002 to 0.005	Cut 1/64 to 3/32 Feed 0.005 to 0.0015	Cut 3/32 to 3/16 Feed 0.015 to 0.030	Cut 3/16 to 3/8 Feed 0.030 to 0.050	Cut 3/8 to 3/4 Feed 0.030 to 0.090
CARBON TOOL STEELS	HSS		175-250	125-175	65-100	35-55
LOW-ALLOY STEELS	Cast Alloy		250-350	200-250	150-200	65-150
	Carbide	500-750	400-500	300-400	200-300	100-300
	HSS		100-150	80-100	50-75	30-50
MEDIUM-ALLOY STEELS	Cast Alloy		210-250	170-200	110-165	55-100
	Carbide	375-500	300-375	250-300	175-250	75-175
HIG-SPEED STEELS	HSS		120-150	75-120	40-75	25-40
HIGH-CARBON	Cast Alloy		130-175	110-130	80-100	35-80
HIGH-CHROMIUM STEELS	Carbide	325-400	250-325	200-250	150-200	50-150

the table, but because of the abrasiveness of the material, it may be found necessary to run at lower speeds. These speeds apply to a dead soft anneal. Progressively harder anneals require progressively slower speeds.

Typical tool angles for single-point tools are given in a table. Hone lightly across the edges of carbide tools. If heat-treated tool steels are machined with carbide tools that are properly ground and honed it is sometimes possible to get a finish that is satisfactory without grinding.

For carbon and low-alloy steels, ordinary soluble oils mixed with 10 to 20 parts water are suitable as coolants. For high-speed and high carbon-high chromium steels, a sulfurized petroleum or fatty oil is generally preferable.

Milling

Climb milling is generally preferred for the tough-alloy, high carbon-high chromium, and high-speed steels. Cutter teeth ordinarily have an 8 to 10° positive rake, 7 to 8° clearance angle, and no land. For conventional up milling, cutters should have 10 to 15° positive rake, 3 to 5° primary clearance and 10 to 15° secondary clearance. They can have a land, usually 1/32 in.

Typical surface speeds and feeds per tooth are given in tables. Higher speeds than indicated have been used with good results by some plants.

End milling is a common operation on die steels, either with straight end mills or with formed cutters. These are generally made of high-speed steel for milling annealed tool steel or hardened dies for hot work, such as forging dies. The design of the cutter will depend on the shape required in the impression. Straight end mills should have a slight back taper to avoid drag.

End milling can be done on fully hardened tool steels when required. Two-lip mills are used for roughing and three-lip end mills for finishing. The mills are carbide tipped and have a back taper. Rake varies from 0 on the 0.250-in. size up to a negative rake of 5° on the 1-in. size. Cutting-edge relief is 0.005 in. in 1/16 in. from the cutting edge with a 14° secondary clearance. The cutter is run at a peripheral speed of 210 fpm with feeds ranging from 0.015 to 0.030 ipr. Depth of cut is about 0.030 in. Milling hardened tool steel is not normally resorted to, but it is useful for repair and for the production of some complex dies.

Carbide milling is generally done without a coolant. For other milling operations, a soluble oil mixed with 10 to 15 parts water is usually suitable for milling carbon and low-alloy steels. For the high-speed and high carbon-high chromium steels, straight mineral oil, a sulfurized mineral oil, or mineral lard oil is preferable.

Drilling

For steels with hardness up to 350 Brinell, high-speed drills are satisfactory. Harder steels require cobalt high-speed or carbide drills. Twist drills should have a heavy web structure, but this should be thinned to about 50% of the original thickness at the point. Drill angles, speeds, and feeds for twist drills of high-speed or cobalt high-speed steel are given in a table. A soluble oil, lard, or sulfurized cutting oil is used.

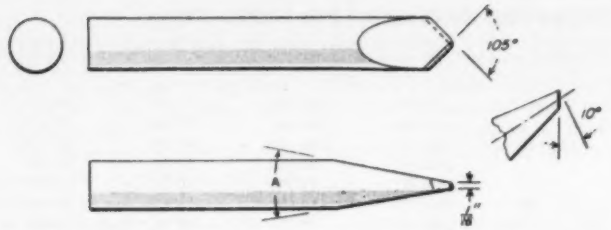
Even the hardest die steels can be drilled with carbide. The simplest drills are a flat piece of carbide brazed into a slot in the shank. The drills are hand fed and care is required not to break them.

A recently developed carbide drill for hardened steel is shown in a drawing with speeds in the accompanying table. This drill is employed for steels between 45 and 65 R_c. For case hardened material, it should only be used to drill through the hard case. Hand feed is preferred. Power feed is possible, and should be 0.002 to 0.003 ipr, except that on the breakthrough hand feed *must* be used. Frequent sharpening is necessary when drilling the hardest steels. Need for sharpening is indicated when the feeding pressure must be increased. A coolant is desirable, which may be air, a dilute proportion of soluble oil and water, or sal soda and water.

Drilled holes in dies have a tendency to "shrink" during heat treatment in some of the tool steels and

Angles (in Degrees) for Single Point Tools

Tool Material	Side Rake	Back Rake	Side Relief	End Relief	End Cutting Edge	Side Cutting Edge
High-Speed Steel	12	8	10	8	10	10
Cast Alloy	8	8	7	7	10	15
Carbide (Annealed Tool Steel)	6	0	6	6	8-12	8-12
Carbide (Hardened Tool Steel)	4	0	5	5	8-12	8-12



Drill for hardened tool steel is ground from solid piece of carbide. Angle A is 10° for drills ¼ in. and smaller and 20° for drills 5/16 in. and larger. Speeds are shown in table at right

Carbide Drills for Hardened Tool Steel

Drill Diameter, in.	Drill Speed, rpm
1/8	1800-2000
5/16	1600-1800
1/4	1200-1600
5/16	1000-1200
3/8	800-1100
1/2	600-800

may require opening up. This can be done with the flat carbide drill described above. There is less danger of runout with a drill made (as shown in the sketch) by grinding four flats on one end of a round piece of carbide of the size desired for the hole. The angle of these flats is not critical but must be identical in each case and they must form a pyramid exactly centered on the carbide.

Reaming

Conventional expansion reamers are satisfactory and permit ease of setup on all of the tool steels in the annealed condition. Standard solid reamers of high-speed steel are satisfactory on the low-carbon low-alloy steels. Reamers are typically run at a surface speed of 30 to 40 sfpm with a light sulfur-base cutting oil which must be generously applied.

For taper holes, roughing reamers may have a 15° right-hand spiral but finishing reamers should have a 28° left-hand spiral.

Carbide-tipped reamers are required for hardened tool steel and may be desirable in any case when machine reaming is to be employed. Power feeding is desirable, and should be 0.002 to 0.004 ipr for hardened tool steel. Roughing reamers have straight flutes and finishing reamers a 5 to 8° spiral. Both have a 7 to 10° rake angle and a cylindrical land 0.002 to 0.005 in. wide. Finishing reamers should have a 2° lead angle for 3/16 in. behind the 45° chamfer.

In hardened tool steel, carbide reamers should be run at 25 to 35 sfpm in sizes up to ¼ in., 35 to 45 sfpm in sizes up to ¾ in., and 45 to 55 sfpm on larger sizes. The amount of stock left to be removed by the reamer is critical:

Diameter, in.	Stock removal, in.
1/8	0.003 to 0.005
1/4	0.005 to 0.008
1/2	0.008 to 0.012
3/4	0.012 to 0.015
1	0.015 to 0.020

A heavy flow of a soluble oil and water may be satisfactory. Better finish will be obtained with a light cutting oil but strong sulfurized oils should be avoided. If chatter develops, increase the feed or decrease the speed. If necessary add a bushing 0.0002 to 0.0003 in. larger than the reamer diameter.

Tapping and Threading

Taps should be of high-speed steel with ground threads. Holes should be tapped with as low a percentage of thread as the application will permit. The general standard for tapped holes is 70 to 75%. This can sometimes be reduced as much as 50% with consequent savings in material to be removed by the tap and a reduction in tapping difficulties. Fine-pitch threads are easier to tap than the coarse pitches.

Tapping speeds for the annealed carbon and low-alloy tool steels are about 30 to 35 sfpm, and for the high-speed and high carbon-high chromium steels are about 25 sfpm. These speeds must be reduced, perhaps as much as 50% when tapping hardened tool steels.

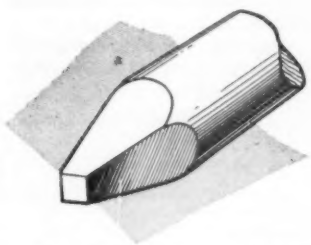
It is often desirable, especially with coarse pitches, to rough and finish tap, perhaps with two roughing operations. Sufficient material must be left for the finishing tap to take an actual cut. For holes 3 in. or less, this should be 0.010 in.; and for larger holes, should be 0.015 in.

Generous quantities of cutting oil must be applied. Sulfurized mineral oils or a mixture of two parts white lead and one part lard oil are suitable.

For thread milling with form-relieved cutters, the teeth should have 5 to 7° rake. Cutter speed is generally 80 to 110 sfpm with a feed of 0.004 to 0.006 ipm for av-

Twist Drills for Tool Steels

Hardness, Brinell	Peripheral Speed sfpm	Feed for Drill Diameters, ipr				Point Angle, deg	Lip Clearance, deg	Chisel Point, deg	Helix Angle, deg
		1/4	1/2	3/4	1				
149	75	0.008	0.010	0.016	0.020	118	12-15	125-135	24-32
196	60	0.005	0.0075	0.010	0.012	118	12-15	125-135	24-32
241	50	0.005	0.0075	0.010	0.012	125	10-12	125-135	24-32
302	40	0.0025	0.004	0.006	0.0075	125	10-12	125-135	24-32
351	20	0.0025	0.004	0.006	0.0075	150	7-10	125-135	24-32
402	15	0.0025	0.004	0.006	0.0075	150	7-10	125-135	24-32



Hole opener of solid carbide will enlarge existing holes

erage requirements and 0.002 to 0.003 when a fine finish is required.

For threading, milled chasers usually have a 5 to 7° rake angle and hobbed chasers a 7 to 10° rake angle. Cutting speeds will vary with the machine and finish required as well as the particular tool steel being threaded. They range generally from 10 to 25 sfpm.

Bandsawing

Contour sawing is frequently employed in the production of dies and provides an economical means of producing them where it can be applied. Die steels must be sawed in the annealed condition. Saws have raker set (one tooth to the left, one tooth to the right, one straight tooth). Typical saw pitch, speeds, and feeds are indicated in a table. Width of the saw blade will depend on the minimum radius to be cut. The saw will not cut if the speed is too fast or slow. The operator can tell by the feel of the work when a speed change is necessary.

To cut a punch and die from a single piece of steel, a patented process is to drill at an angle from the punch area at the top into the die area at the bottom. The saw table is tilted (but a lesser amount) and the blade run through the hole in the steel and welded. With the cut made at an angle, extra material is left on the die at the top and on the punch at the bottom. These are filed to form the necessary straight sides.

Friction sawing may be applied to hardened tool steels that do not have too much red hardness. The saw is run at very high speeds, generally about 15,000 fpm. Momentary contact of the saw produces enough heat to soften the work, but the saw teeth have time to cool before returning to the cut. Dull teeth cut better than sharp ones because they have more friction with the work. It is often necessary to knock the points off the teeth of a new blade with an emery stone before cutting tool steels. Tooth pitch generally ranges from 10 to 18 per inch. Proper pitch is essential for too many teeth will load and too few teeth will try to cut into the material before it is softened. Fewer teeth are required for thicker work.

Thickness up to ½ in. and more can be cut without difficulty. Thicker material can be cut when necessary by rocking the work up and down to present a point to the work, concentrating the heat in a small section of the cut.

Typical Bandsawing Speeds and Feeds

Material	Work Thickness, in.	Saw Teeth: Set	Saw Teeth: Pitch	Saw Velocity, fpm	Feed, ipm
HIGH-SPEED STEEL	1/16	Raker	24	150	
	¼	Raker	14	125	4.5
	1	Raker	12	75	1
	3	Raker	8	50	1/16
HIGH CARBON-HIGH CHROMIUM	1/16	Raker	24	150	
	¼	Raker	18	100	2.5
	1	Raker	14	75	0.5
	3	Raker	8	50	1/8
OTHER TOOL STEELS	1/16	Raker	24	175	
	¼	Raker	18	125	4.5
	1	Raker	14	100	1
	3	Raker	8	60	1/16

Machine Filing

Speeds for machine filing are about 100 fpm for high-speed and the high carbon-high chromium steels. They range up to about 150 fpm for annealed carbon and low alloy steels. Pressure required will range from 20 to 40 lb depending on the nature of the work, but should be uniform. Bastard-cut files are used for all filing except finish filing which will require a mill cut.

Grinding

The most frequently encountered operation on tool and die steels is grinding. The work must usually be ground after heat treating to bring it to final size or produce a desired finish, and sharpening or repair is done by grinding.

The high carbon-high chromium and high-speed steels are the most difficult to grind. Grinding produces intense local heat developing severe momentary strains. If too heavy a cut is taken, small cracks or grinding checks will form on the surface. Usually this condition will be accompanied by temper colors on the surface. So

Rake Angles for Face Milling

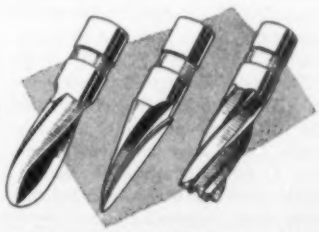
Cutter Material	Radial Rake, deg	Axial Rake, deg
High-Speed Steel	10	10
Cast Alloy	0 to 3	0 to 3
Carbide	0 to —10	0 to —10

Speeds for Milling Tool Steel

	High-Speed Steel Cutters, sfpm	Carbide Cutters, sfpm
Annealed	50-90	250-300
Heat Treated	40-70	200-250

Feed Per Tooth for Milling

Cutter Material	Hardness	Face Mills	Helical Mills	Side Mills	End Mills	Form Relieved Cutters	Circular Saws
HIGH-SPEED STEEL	180-220 Bhn	0.008	0.007	0.005	0.004	0.003	0.002
	220-300 Bhn	0.006	0.005	0.004	0.003	0.002	0.002
	300-400 Bhn	0.004	0.003	0.003	0.002	0.002	0.001
CARBIDE	180-220 Bhn	0.014	0.011	0.008	0.007	0.004	0.004
	220-300 Bhn	0.012	0.010	0.007	0.006	0.004	0.003
	300-400 Bhn	0.010	0.008	0.006	0.005	0.003	0.003



Formed cutters of HSS are made in many shapes for die sinking

Typical Grinding Wheels, Disks, and Points for Tool and Die Steels

Operation	Abrasive Type	Grain Size	Grade	Structure	Bond	Speed, sfpm
SURFACING—HARDENED						
Wheels, straight or recessed (Dry)	alum. ox.	46	H	8	Vitrified	4500-6000
(Wet)	alum. ox.	46	J	5	Vitrified	4500-6000
Cup wheels (Wet)	alum. ox.	30	H	8	Vitrified	4500-6000
Disks	alum. ox.	46	J	7	Vitrified	4500-6000
				5	Resinoid	6000-7500
Segments	alum. ox.	30	E	12	Vitrified	4500-6000
SURFACING—ANNEALED						
Wheels, straight or recessed (Dry)	alum. ox.	46	I	8	Vitrified	4500-6000
Cup wheels	alum. ox.	24	I	8	Vitrified	4500-6000
Disks	alum. ox.	24	I	8	Vitrified	4500-6000
Segments	alum. ox.	30	G	12	Vitrified	4500-6000
CENTERLESS	alum. ox.	60	L to M	5	Vitrified	5500-6500
CYLINDRICAL	alum. ox.	60	K to L	5	Vitrified	5500-6500
INTERNAL	alum. ox.	46	J	5	Vitrified	5000-6000
CUTOFF (Dry)	alum. ox.	36-46	M to R	7 to 8	Resinoid	9000-12000
(Wet)	alum. ox.	54-60	P	0	Rubber	9000-12000
PORTABLE TOOLS						
Mounted points:						
Coarse	alum. ox.	60	O to R	6	Vitrified	to 25,000
Medium	alum. ox.	80 or 90	M to R	6	Vitrified	to 25,000
Fine	alum. ox.	120	M to R	5	Vitrified	to 25,000
Wheels, straight or recessed (for roughing)	alum. ox.	46	Q	6	Vitrified	5000-6500
	alum. ox.	36	Q	5	Resinoid	8000-9500

long as this color does not appear there is not likely to be any danger. With the carbon and low-alloy steels, very little heating is required to draw the temper out of the steels. Wheels, in general, have coarse or medium grain size and are soft or medium grade. Mounted wheels and points for portable grinding must be of harder grade. The cut should be light in all grinding operations.

Wheels are made of aluminum oxide abrasive with vitrified bond except in a few cases. Wheel recommendations are given in the table. An exception to these recommendations should be noted: For light finishing cuts on the tungsten, 18-4-2 and the cobalt-bearing high-speed steels, silicon-carbide wheels are sometimes employed. They range from 60 to 120 grain in the soft and medium grades.

Surface Grinding—The abrasive must be sharp and free cutting, in the soft range of grade, and the wheel must have an open structure to avoid overheating. Softer grade wheels are required for the more wear-resistant steels.

When surface grinding with the periphery of straight or recessed wheels, wheel speed should be about 5000 sfpm. vertical speed should be 0.0005 to 0.0010 in. per pass, table speed 20 to 30 fpm, and cross speed about 1/32 in. per pass. Dry grinding will generally produce less burning and discoloration than wet grinding. If wet grinding is necessary, the coolant supply must be in a generous, constant stream to prevent localized heating.

On hard steels a soft wheel, high speed, and light in-feed are likely to result in a burnished surface and excessive wheel wear with little stock removal. Try more moderate wheel speed in such cases.

Cylindrical Grinding—Cylindrical grinding of dies is confined largely to straight and tapered punches. It may be done wet or dry on a universal tool and cutter grinder or a small cylindrical grinder. With wet grinding, be sure to supply a generous supply of coolant.

Internal Grinding — Internal grinding is employed on blanking and forming dies where accurate surfaces are required. Toolpost grinders or internal grinding attachments mounted on lathes are commonly used for internal work on large and heavy dies. The grinding wheels must be of grade hard enough to retain its shape.

Offhand Grinding—Most of the grinding on die impressions is done with mounted wheels and points driven by flexible shafts on portable grinders. The wheel specification will depend primarily upon the size and shape required for the particular job. They must be hard enough to retain their shape. The grain size depends primarily on the finish required.

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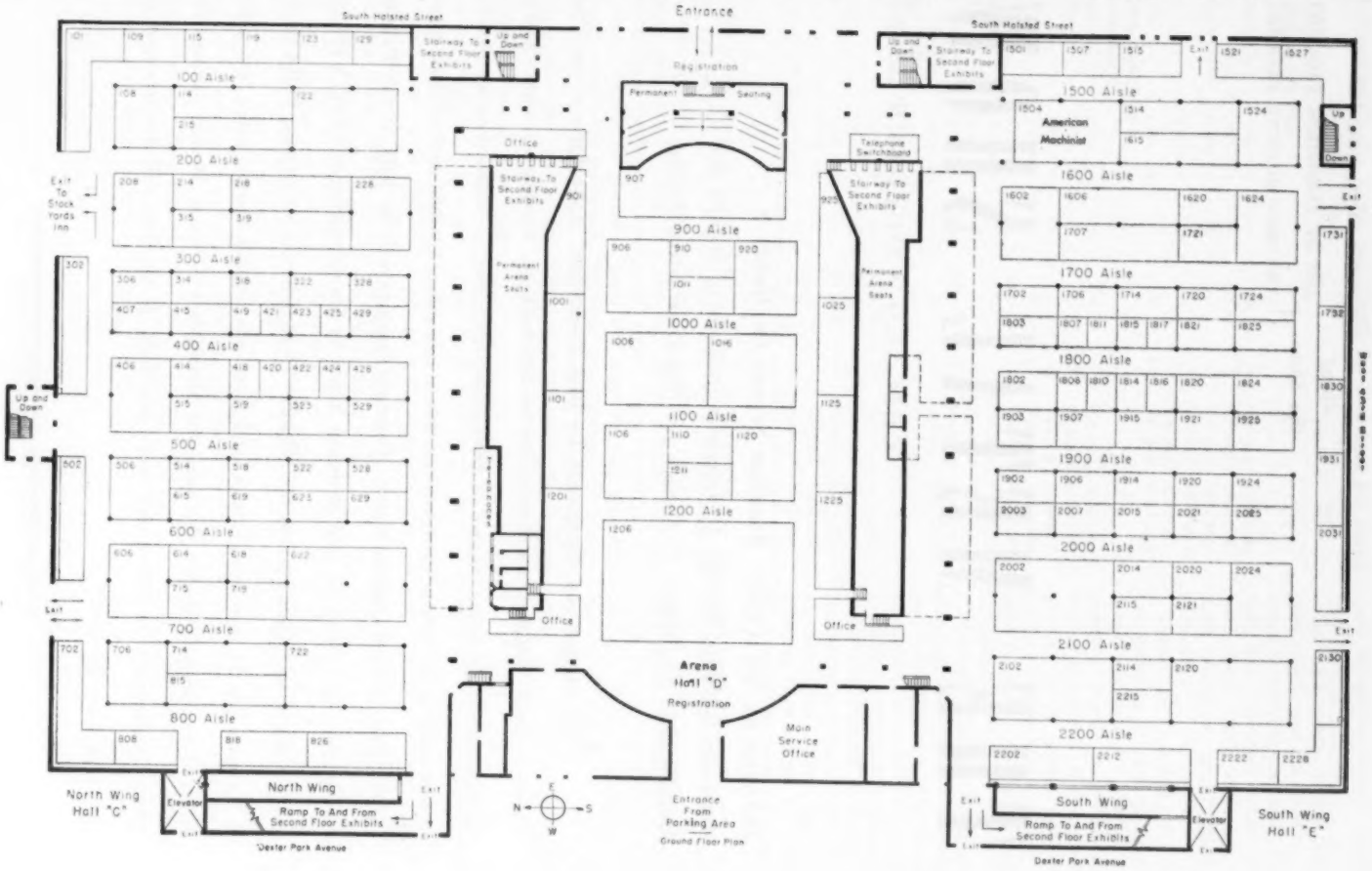

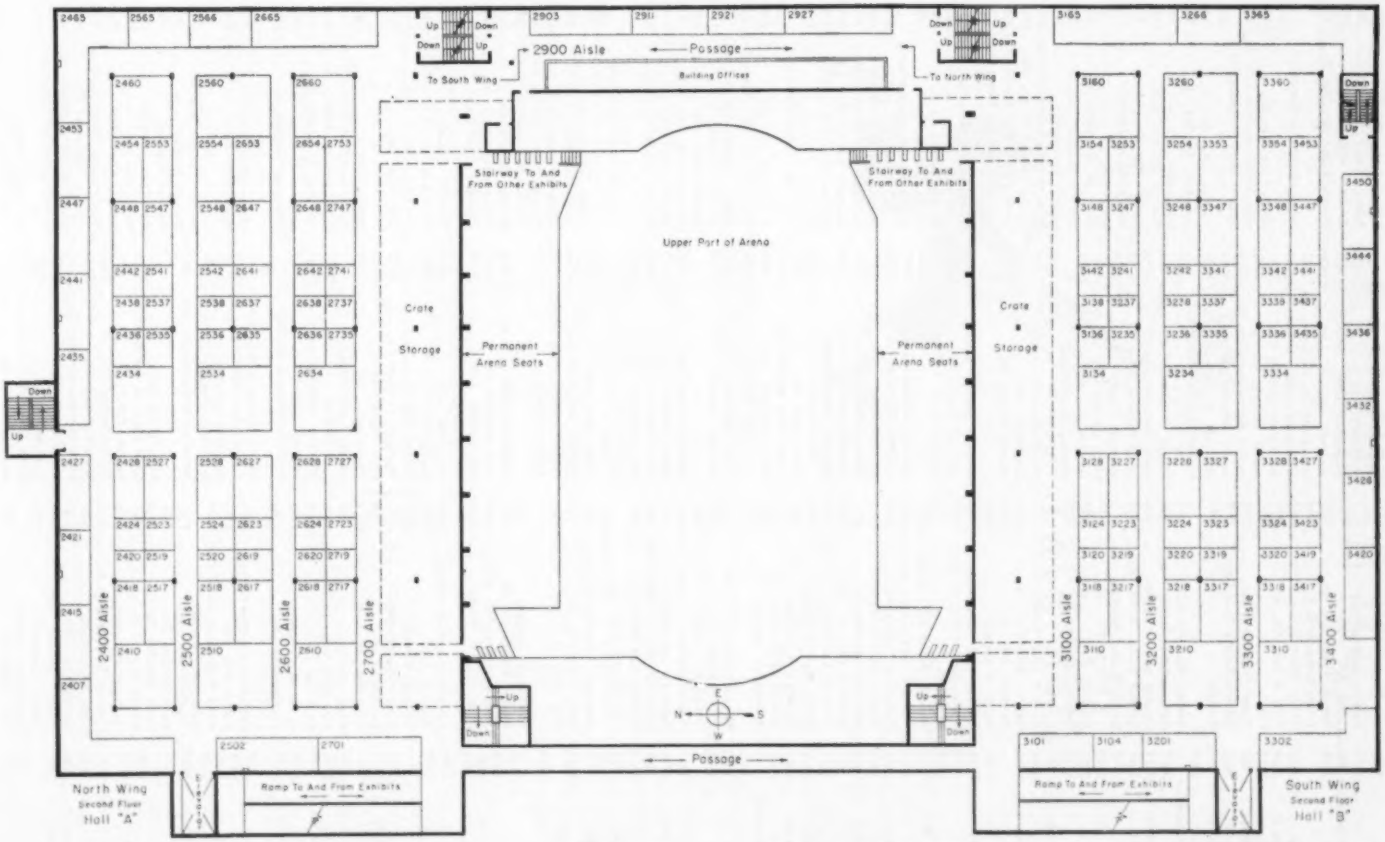

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ROUND TABLE

Pack Rats

Ed dropped in at Al's midget office just in time to see his friend push aside a list of figures and grind his teeth.

"What's up, Al? You look like you'd lost your last length of ½-in. cold-rolled."

"It darn near amounts to that, Ed. I was just adding up our running inventory to see if I could spot some shortages. Harris says he lost a ten-inch hunk of yellow brass overnight, and Thomas missed a piece of flat tool steel yesterday. I'm blessed if I can see a way we can avoid searching those guys every night."

"Oh, now, wait a minute. You know that every department loses a certain amount of choice stock and tooling. You just can't avoid it, Al. If you go and make things embarrassing for the men, you'll wind up with a shop-full of bandits."

"Well, I can't let them get away with it, can I? If they steal a piece or two today, they'll carry off a couple tomorrow; and next week we'll start missing small tools!"

"It's not as bad as that. You have to expect some loss, and if you start accusing them of stealing, it'll turn into a game where they try to outwit you and you have to get tough. You can't afford that, Al. You can't have the gang mad at you, and you can't let them get your goat, either. Just forget it!"

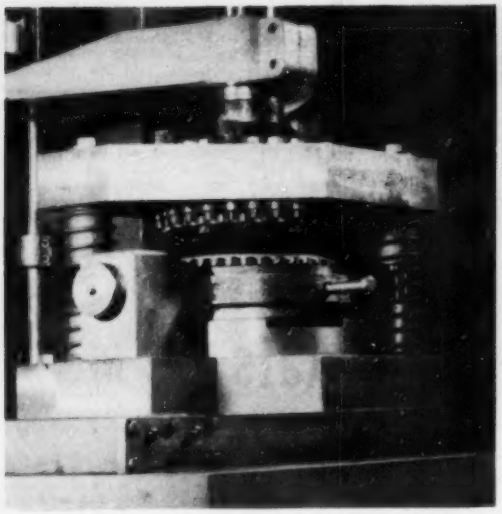
"Oh, nuts! Look—if I lose too much stuff here, Harrison is going to put me on the carpet for being inefficient. Is my duty to play namby-pamby with the men, or is to do a good job for the company and do myself justice in the eyes of upper management? Evidently I can't do both."

"Yes, you can do both if you're smart about it. First thing, don't get all in an uproar about a little stock. Of course if you lose something really valuable, you'll have to ask questions—and ten-to-one you'll find out what happened. Providing, of course, that you allow the men a little leeway in the meantime."

"Holy crow, how much is a 'little' leeway? Next thing I know, somebody will walk off with that ten-inch girder over there. You can't let them start pilfering, Ed. You have to stop it immediately . . . I wonder if one of those radar sets would detect stolen metal in the men's pockets?"

"You're making me feel guilty, Al. I guess I'll have to put back that piece of silver solder I was going to take home to fix a ring with. But seriously, I don't believe you should make any point of little things turning up lost. It only starts trouble."

WHO'S RIGHT? Is strict adherence to the company's property rights just looking for trouble -- bad morale, distrust, hurt feelings, and such? Or can't you let anyone get away with anything? What, for example, is a good way to detect "lifted" property? Discussions on earlier topics appear on later pages.



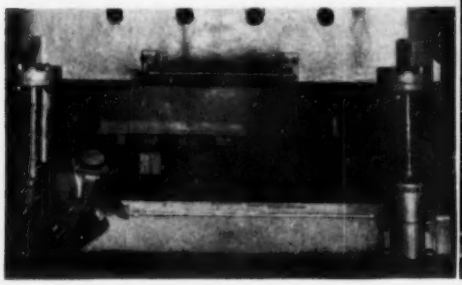
PRESS UNIT DRIVES 24 RIVETS AT ONCE

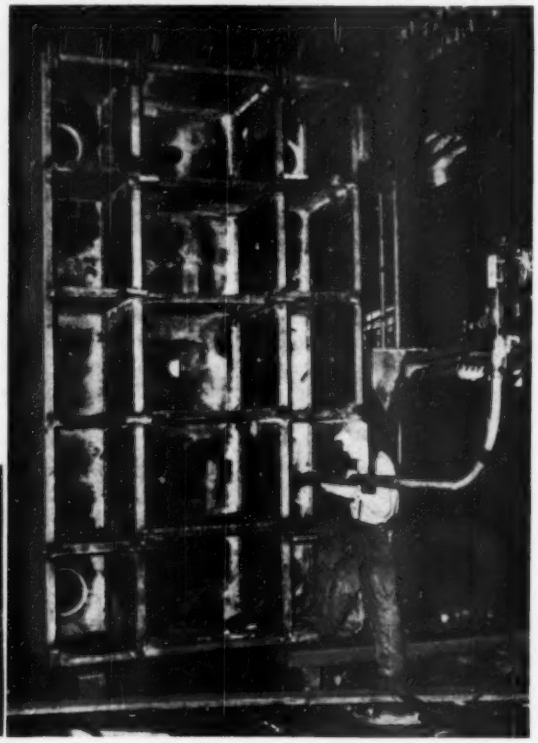
Rear-wheel-sprocket and brake-hub assembly for motorcycle are riveted together when one smack of a 50-ton hydraulic hits spring-supported adapter. Top die drives 24 pins to head rivets against ring adapter. Setup maintains concentricity; can be switched for other similar jobs. *Harley-Davidson*

TALENTED ☆ TOOLING

SPLIT PRESS BASE REPLACED WITH WELDED BOX

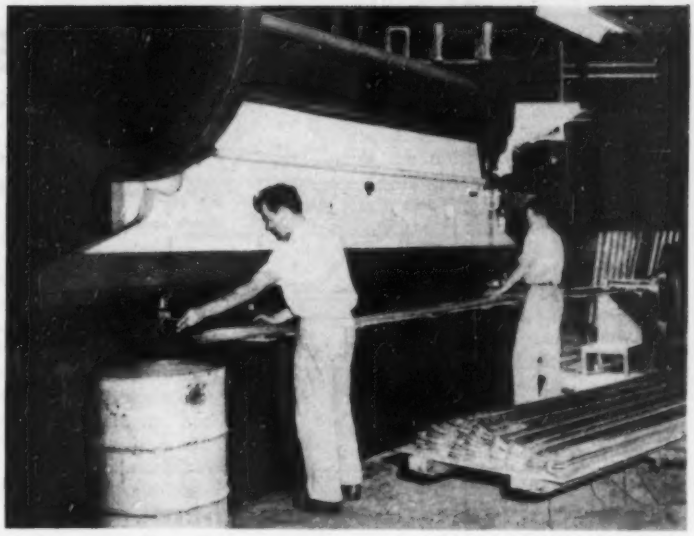
Hydraulic forging press built in 1916 was fitted with new base 13 ft by 7 ft, 7 in. by 3 ft, 10 in. high. Top plate was 5 in. thick, bottom 3 in., and sides 2½ in.; joined by Unionmelt. Finished box weighed 10 tons, supports 1100-ton press. *Linde Air Prod.*

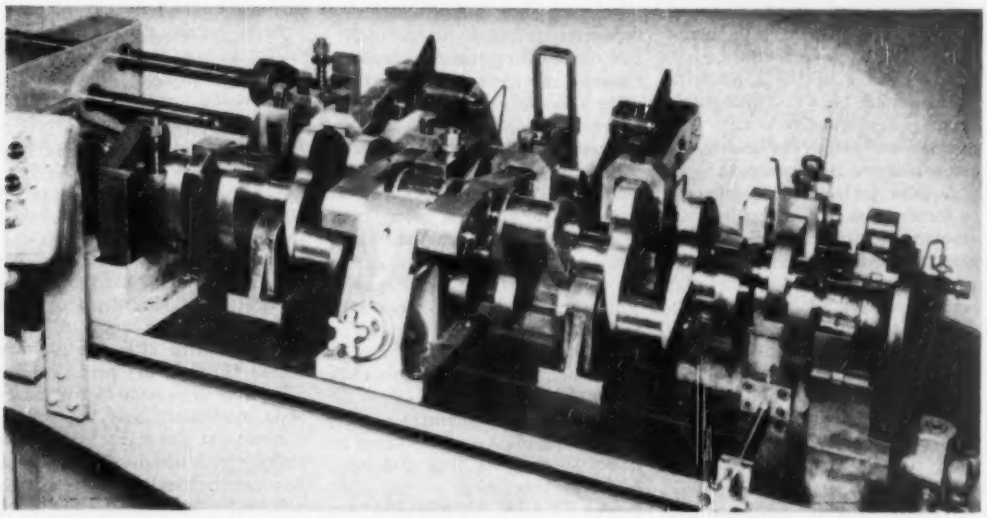




COMBINATION DIE BLANKS AND FORMS SPRAY RAILS

Aluminum boat rails, formerly made in 11 operations, are now formed, cut to length, and ends are cut to radii and flattened with one press-brake stroke. Dies are sectionalized, with two end sections and straight die forms between them. Stock is fed from coil. *Texas Eng. & Mfg. Co.*

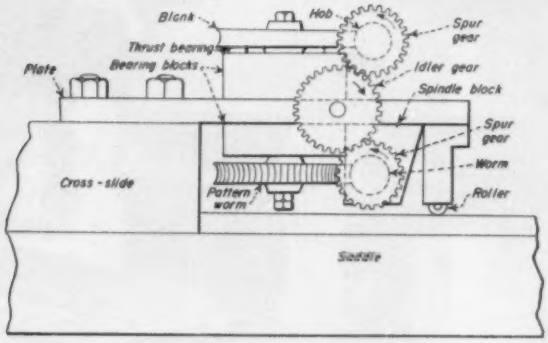




HORIZONTAL DRILL LIGHTENS CRANKSHAFT

Two fixtures support cranks directly in line on six-spindle machine so three spindles can drill 1⅝-in. holes in left-hand setup and three can ream in right setup. Tool load is balanced by rotating shafts so equal depth of tough material is cut at each stroke with only 20 hp. Drills are cooled by oil-tube feeding; reamers by flushing. *Le Maire Tool & Mfg. Co.*

Practical Ideas



Synchronized Lathe Attachment Cuts Worm Wheels

AN IMPORTANT POINT when a worm wheel is being cut is that the blank should rotate in mesh with the hob that is cutting it. For a batch of double-start, ¾-in., phosphor-bronze worm wheels we were producing, we made the illustrated setup to meet this condition.

A solid tool-steel bar was cut to form a hob of the required diameter and tooth form—located about in the middle of the bar. The bar was then chucked in the lathe, between headstock and tailstock, and was turned down at the headstock end to allow keying a small spur gear to it. The gear was from our scrap box, although a lathe change gear might have been used. The main requirements were that there be two identical gears, and that the teeth be fairly coarse.

A husky spindle was made to carry the pattern worm wheel at one end and the blank at the other. To hold this vertical, a heavy mild-steel plate was clamped to the cross-slide of the lathe, and a split bearing block was mounted on the plate—partly above the plate, and partly below. The plate and blocks were drilled through vertically to take the spindle. To take thrust from the blank, which was mounted on top of the bearing block, a recess was milled out to admit a thin, light-duty ball thrust bearing under the blank.

As outboard support for the overhanging end of the plate, a block with a roller seated in its lower end was added. The roller rested on the lathe saddle as the rig moved back and forth slightly so the hob would cut into the blank.

To synchronize the rotation of blank and pattern, another block was added to the lower side of the main plate. This carried a spindle which held a worm—to mesh with the pattern worm wheel—and a spur gear—to mesh with the spur on the hobbing bar through an idler gear.

The idler was mounted on the edge of the plate, but was fixed so it would move slightly and keep both spurs in mesh as the slide moved to feed the hob into the blank. This was managed by spring-loading the stub shaft that carried the idler gear.

The complete setup worked with the lathe spindle providing the power, rotating slowly. The headstock rotated the hob and spur gear while the idler, second spur gear, and worm rotated the pattern, spindle, and blank in mesh with the hob. Infeed was provided by shifting the cross-slide. *Dan Penway, Carlisle, England.*

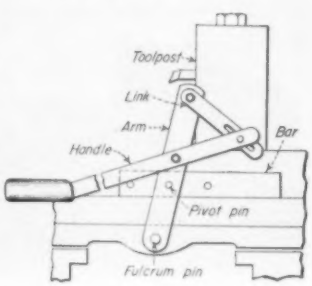
Toolpost Control Handle Features Two Adjustments

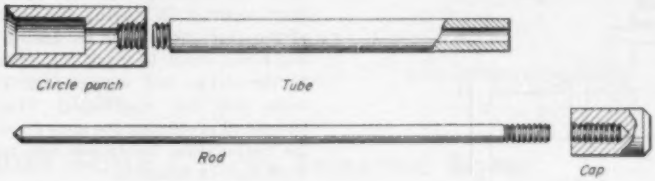
AFTER MAKING a turret-style back toolpost for one of our lathes—which is similar to an Atlas type—we found it necessary to add a control handle that would advance the tool into the work. The illustrated linkage provided height adjustment (for operator convenience) and stroke adjustment (for different diameters of work) to control the toolpost.

A mild-steel bar was bolted to the end of the slide on which the toolpost was mounted. Below this, in the saddle, a hole was drilled and tapped so a vertical arm could be pivoted around a fulcrum stud driven into the hole.

Three holes into the bar were drilled to take a pivot pin, which also went through a hole in the arm. At the top of the arm a bolt and nut connected a short link. The other end of the link had a slot instead of a hole, which allowed adjusting the location of the end of the control handle before the bolt was tightened.

The final connection was between the control handle and the vertical arm, slightly above the pivot pin into the block. All bolts were tightened after the pin was seated through the arm into the right hole to provide the necessary slide movement, and the control arm was at the right height. The toolpost was advanced by pushing down on the handle. *Ian J. Peacock, Ainstable, England.*





Transfer Punches Locate Circle and Center

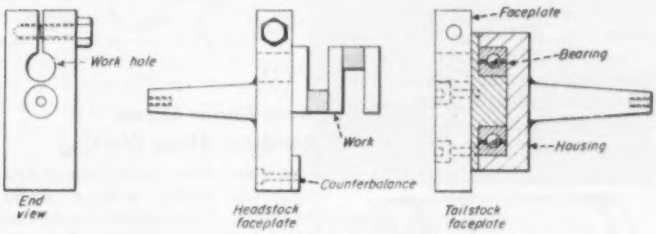
THIS SET of transfer punches covers the most popular sizes of screws, and is designed for holes with 1/32-in clearance for the nominal screw sizes.

The outer punch, which is a circular punch with the bevel ground toward the outer edge, and the inner punch, which is a simple, small-diameter rod ground to a conical point, are made of tool steel, hardened, and drawn. The other parts are machine steel.

A punch set is assembled by threading the tube into the back end of the circle punch, then threading the point punch into the cap, and finally inserting the point punch into the tube. A sharp hammer blow on the cap marks both point and circle on the work, provided the dimensions are right.

The parts are made so the cap will thread onto the rod for a length of ⅝ in. Each cap is 1 in. long, and each circle punch is 2 in. long. For a screw size of ¼ in., the tube (not counting the thread) is 2⅜ in. long, the rod (counting ⅝-in. thread) is 5 in. long, circle-punch diameter is 0.280 in., and rod diameter is 5/32 in. Sizes for other screws are proportional.

The main advantage in this kind of locating punch is that the cutting edges can be easily sharpened. Because the bevels on both circle punch and the rod are the same (45°), sharpening can be done by grinding the same amount of stock off each punch. *Stephen W. Nedela, Port Huron, Mich.*



Faceplates Hold Crankshafts For Grinding

TO FACILITATE the grinding of a number of small crankshafts, two matching faceplates for a lathe setup were made. These were designed to swing the bearing area of each shaft on lathe center.

The headstock faceplate was mounted on a tapered arbor to fit the spindle nose of the lathe. A hole drilled off center and cut into with a saw cut from the end of the plate held the end of the shaft, which had to be off center so the bearing would be on center. The opposite end of the plate was counterbalanced so the weight of the crankshaft would swing without wobble.

The tailstock faceplate was almost identical, except that it was mounted on a ball-bearing-supported arbor. This, too, was drilled off center so a second setup could be made with the end of the shaft in the tailstock—allowing grinding of the other bearing area on the shaft.

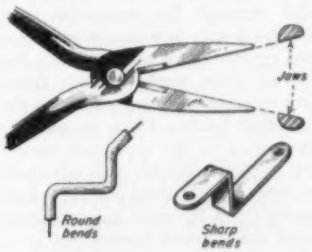
With the shaft mounted in either faceplate, the tailstock was moved up toward the headstock until contact was made. When the work was mounted in the headstock faceplate, the tailstock faceplate simply was pushed against the work to support and guide it. With the work in the tailstock faceplate, the work had to be moved up to contact the headstock so it would be rotated as well as supported and guided.

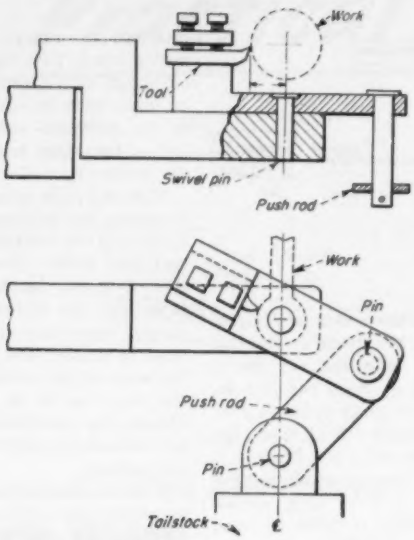
Work was mounted in the hole in either faceplate, the bolt through the split section of the plate was tightened, and the work was centered with a dial indicator before final tightening and clamping. *R. G. Vare, Holmsley, England.*

Double-Purpose Pliers Don't Break Insulation

WHEN BENDING electrical wiring to various shapes, you can prevent the insulation from becoming nicked or broken by utilizing long-nosed pliers that have been altered slightly.

Standard pliers—not side-cutters—can be formed to a cutting edge if the steel is right for hardening or if it is already hardened. One edge of each prong can be sharpened, as shown, while the other two edges are ground off to rounded shapes. The result is a pair of double-purpose pliers that can handle bending or cutting. *Fred Lettino, Astoria, L. I., N. Y.*





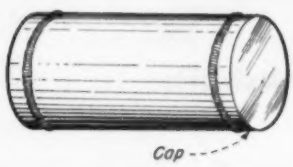
Radius-Turning Tool Mounts in Lathe Toolpost

TO CUT SMALL RADII with good accuracy, this rig is made to fit in place of a normal toolholder on an engine lathe. Although the range of sizes the rig can cut is somewhat limited, the support is firm and the toolbit is easily adjusted.

A main body is cut to allow one end to be clamped in the toolholder. This body is overhung and bent—or cut to step shape—so the rig will clear the work and the bit will align with the center of the work. A toolholder is supported by the main body under the centerline of the lathe spindle, where a swivel pin is located. At the opposite end of the rig, a push rod is pinned to the toolholder part.

Cutting is done with a simple, single-point toolbit mounted in a slot through the toolholder and clamped with two setscrews. Once the rig is set and located under the center of the work, the only feeding required is done by moving the tailstock center. Here, an adapter is pinned to the push rod to revolve the toolholder as it advances or retracts. Uniform motion is best maintained by slow hand feeding with the tailstock handwheel.

Gaging the setting to the toolbit is done by slipping a long pin into the hole in the middle of the rig instead of the swivel pin. A rough gage block is made to the radius of the work minus the radius of the long pin. This is inserted between the bit and the pin, and the bit—after it is ground—is moved forward to touch the gage. The gage and long pin are removed, the swivel pin is inserted again, and the rig is ready to cut. *Gerhard Wenke, Los Angeles, Calif.*

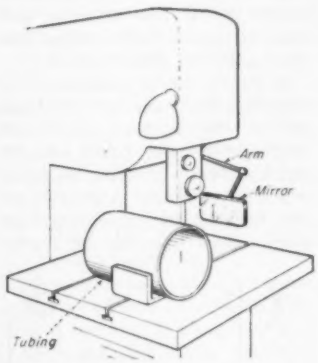


Caps Keep Cores Soft During Hardening

WHEN MAKING some special long bushings from low-carbon stock recently, we found that the bushings had been cut to length before heat-treatment. This meant that we had no extra stock to remove after carburizing, which would have resulted in leaving the core of the stock soft after hardening. We didn't want to mask the ends of the stock, and copper-plating them was not economical. Our method of protecting the ends from the carburizing treatment was to weld caps on them.

These were simple round disks, and were welded securely to the stock. Weld metal was built up to insure that the stock, after the caps were removed, would be full size. The stock was carburized, then the caps were turned off and the parts were hardened.

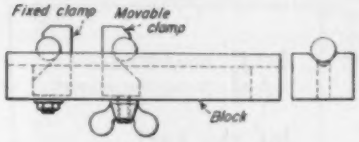
After treatment, the ends of the parts were soft, and the drilling job which made thin-walled bushings—could be done easily. *K. I. Rogers, New York, N. Y.*

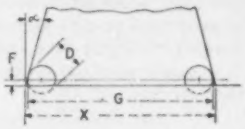


Auto Mirror Shows Bandsaw Blade Working

OUR SHEET-METAL DEPARTMENT cuts large-OD tubing with a metal bandsaw. The ends of the 10- or 12-gage sheet-iron tubes have to be cut at various angles, but until we rigged an auto rear-vision mirror on the machine the operator was unable to see his cut mark on the opposite side of the tube.

The mirror is attached with an adjustable arm to the main housing of the bandsaw. This allows the operator to stand on the side away from the blade, where he can push the work to be cut. He can line up the work exactly by looking into the mirror. *R. L. Cofran, Enterprise, Kansas.*





Ball Gage Checks Tapered Bores

THIS DESIGN shows a device for measuring the diameters of tapered bores with various taper angles within a wide range of sizes.

The main block is formed from a bar that is milled flat and parallel. A 90° V cut is made the length of the bar, and a 3/16-in. slot is cut through the bottom of the V for most of the length of the block. Sufficient stock is left at each end for strength. The length of the block can be suited to the range of bore sizes that might need to be checked for diameter.

Two clamps, cut as shown to grip partly around round balls, are made from 3/16-in. flat stock. These project through the slot, and grip the balls, which rest in the groove above the slot. The clamp at one end is permanently held there by a regular hex nut, while the other clamp is movable when the winged nut is released slightly.

Both clamps face out so the balls are exposed to the ends of the main block. The device is used by holding it firmly against the face of the work to be checked. The fixed ball is held against one edge of the bore, and the other ball is pushed to the opposite edge of the bore by loosening the winged nut and pushing the clamp along the slot. The nut is clamped when the balls are separated as far as they will go, and the assembly is removed and a micrometer reading is taken across the balls.

The true ID of the tapered bore at the end of the work is found by applying this formula:

$$X = G - D + \frac{D}{\cos \infty} + 2F\tan \infty$$

D is the ball dia.
G is the micrometer reading.
F is the distance from surface of the main block to the centerline of the two balls—a constant dimension that must be measured only once. This can be stamped on the gage, if desired. X is the diameter required. This dimension is, of course, for the large end of a tapered bore. The smaller end can be measured directly with an inside micrometer, and no conversion will be required. Accuracy of the measuring method is controlled by care in clamping the ball. *R. Mery, Farmingdale, L. I.*

Emery Wheel Does Endless-Belt Buffing

ONE OF THE HANDIEST pieces of equipment in our machine shop is a common shoemaker's split-felt buff with a strip of emery cloth wrapped around it. Mounted on the shaft of a ¼ or ½ hp motor, this tool is ideal for burring, sanding, polishing, grinding, etc. The emery has a soft action.

The tool is economical to make, and emery cloth is also inexpensive; yet the equipment does the job of endless grinding belts. A worn strip can be replaced in a matter of seconds from a stock of several rolls of emery cloth of various grits. *Bernard Levowich, Brookline, Mass.*

Press Brake Cuts Rubber Sheets True

THICK RUBBER SHEETS, used as deflectors on Wheelabrator equipment, are cut with a sharp blade in place of a normal bending blade on a press brake. Cutting the material this way eliminates difficulties we had previously had in getting edges straight and true.

The sharp blade is backed by a piece of 54x4x4-in. hard maple fastened to the bed of the brake. This also protects the blade from being dulled and chipped as it comes down through the rubber.

A stop in back of the brake is adjusted for the thickness of material desired. The blade and hardwood back can be mounted on any brake we have in the shop, so rubber cutting can be done on any available machine, which means this production will not interfere with other jobs. *M. E. Frazee, South Bend, Ind.*

Ball Gage Checks Bushings

WE HAD about a thousand small bushings with holes reamed to 0.6255—0.627 in. About half way through the job, we discovered that the reamer had worn undersize; but the bushings were mixed up and we couldn't tell which ones were good.

Instead of purchasing an expensive gage, which might have cost us a lot in time as well as money, we decided to try a makeshift gage that would weed out the bad bushings quickly.

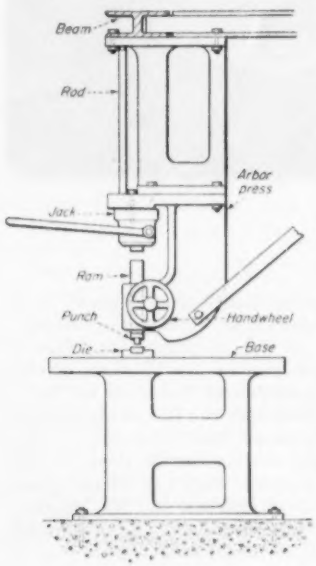
The gage illustrated was made up in a few minutes, and did a surprisingly good job. The ball was from an old bearing. It was in good shape, however, and was exactly ⅝ in. in diameter. A ¼-in. rod was brazed to the ball to form a handle.

By passing the gage through the bushings we found the good ones. Undersize bushings would, of course, not pass the gage. *Irving Mansfield, New York, N. Y.*

Arbor Press Hangs from Ceiling To Punch Rectangular Slots

A JOB that recently taxed our equipment and ingenuity almost to the breaking point was a sheet of hot-rolled, 12-gage steel measuring 42½ x 44 in. Into this plate 192 rectangular holes (1 1/16 x 6⅞ in.) were to be cut, leaving narrow strips between the holes.

The only equipment that we had which would reach across the plate was a large radial drillpress. We abandoned the idea of laying out, drilling, and filling the holes in favor of piercing with punch and die. What we needed was a large press instead of the several small punch presses we already had in the shop.



After much planning, we found we could use a small, sturdy arbor press. This was turned upside down and bolted securely to heavy I-beams supporting the ceiling about 8 ft above the floor. A new ram was made and a punch holder and punch was attached to the lower end of the ram, which was inverted. The regular press handwheel permitted moving the ram up and down. A strong mechanical jack was inserted between the ram and the anvil of the arbor press to apply pressure to the ram.

The bed of an old dismantled machine held the die. Holes were drilled in the concrete floor and studs were embedded to secure the machine bed. A few braces were added to stiffen the inverted press.

After careful layout directly on the work, the plate was located exactly under the punch, pressure was applied with the jack, and the holes were cut through. Adequate clearance and generous shear were ground on the punch. No stripper was necessary. *Abram Hill, Philadelphia, Penna.*

$25 *In addition to regular payment*

for the best PRACTICAL IDEA

An extra payment of $25 will be made for the best Practical Idea in each number of *American Machinist*. To avoid bias, the selection will be made by readers, a different group each time.

PAYMENT—$25 in addition to regular rates for the item as published, to be paid as soon as reader votes are received—usually three to four weeks after the date of the issue. The winner will also be announced in these pages as soon thereafter as practicable.

JUDGES—A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, select the best Practical Idea. If at any time their votes result in tie, $25 will be paid to each and every co-winner. Decision of the readers will be final in each case.

REQUIREMENTS—Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worry about your shortcomings as a draftsman, photographer or author—every item will be edited in accordance with *American Machinist* standards and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product—in terms of its usefulness to them.

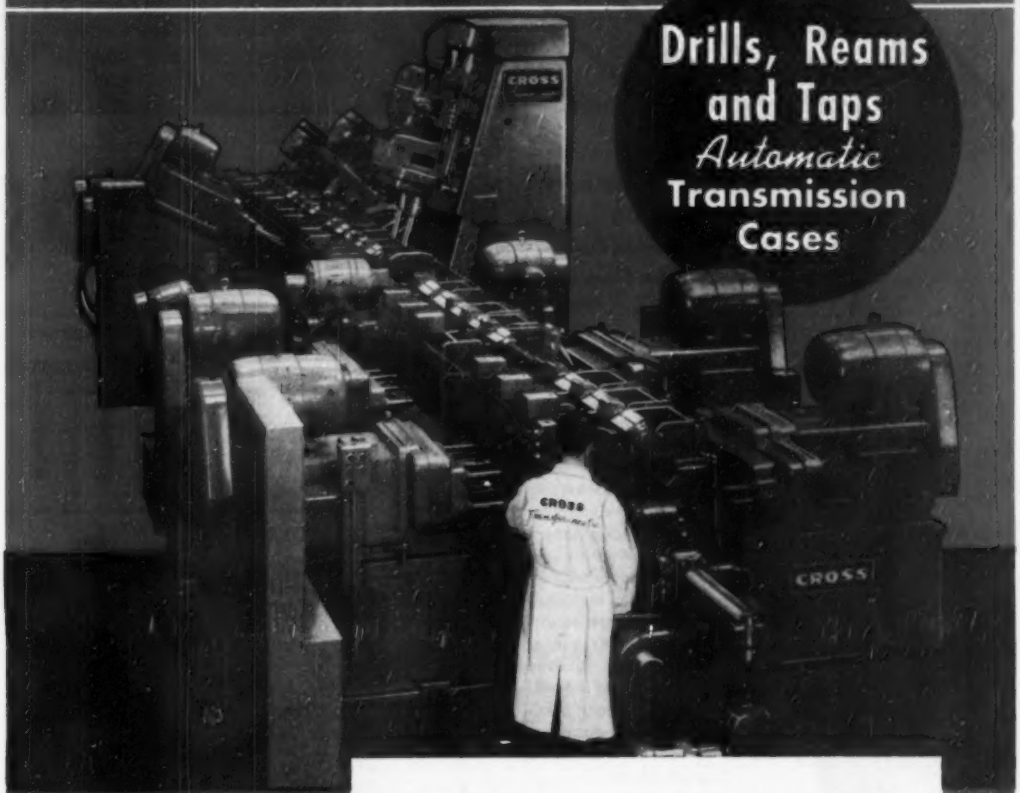
WHO MAY ENTER—Anyone may enter except employees of the McGraw-Hill Publishing Co., Inc., and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER—Send your entry to "Practical Ideas Editor," American Machinist, 330 West 42d St., New York 18, N. Y.

110th Winner:

Basil Clark
Press-fit Reamers

Another Transfer-matic by Cross



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★ 28 stations—1 loading, 7 drilling and 5 idle for ends, 1 indexing, 10 drilling and 4 idle for sides and top.

★ 83 cutting tools working on 32 different holes.

★ Part automatically indexes 90° in Station 14 to position for subsequent drilling of sides and top.

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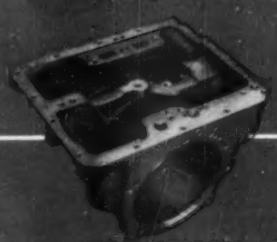

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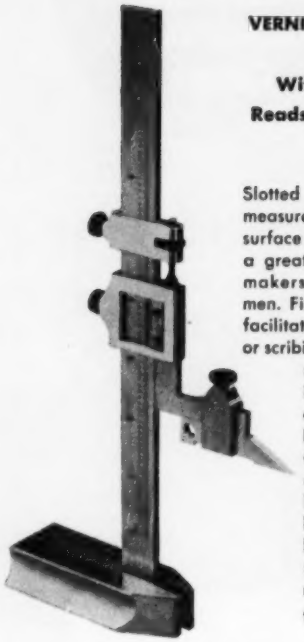

VERNIER HEIGHT GAGE
No. 354
With Slotted Base — Reads Direct From 0-6"

Slotted base permits direct measurements from the base surface without calculations... a great time saver for toolmakers, inspectors, layout men. Fine vertical adjustment facilitates accurate measuring or scribing. Scriber readily removable for sharpening and reversible with convenient mounting hole for dial indicator. Other features: adjustable Vernier plate; base and scriber hardened and lapped; hardened bar; accurate, easy-reading, machine-divided graduations.

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UNIVERSAL PRECISION GAGE NO. 995 (Patented)

Combines the unique features of fine adjustment with universal adaptability. Knurled thumb screw sets the gage precisely — clamp nut locks the setting. Available with offset foot for narrow areas and working below base line and scriber for use as surface or height gage.

NEW
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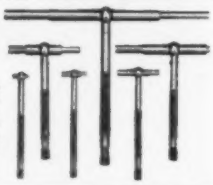

An improved telescoping gage with automatic, self-centering handle and twin contact plungers. Rounded contacts are hardened and ground; telescope under uniform spring tension; lock at any setting. Six sizes cover the range 5/16 to 6".

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NEW
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Standard Spring Lockwashers

AMERICAN STANDARD B27.1—1950. PUBLISHED BY THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS, 29 WEST 39TH ST., NEW YORK 18, N. Y. PRICE 75 CENTS

Nominal Size	Inside Diameter Min	Clearance of Nominal Bolt Size Min	Clearance of Nominal Bolt Size Max	Washer Sections (Minimum) Light Width w	Light Thickness $\frac{T+t}{2}$	Medium Width w	Medium Thickness $\frac{T+t}{2}$	Heavy Width w	Heavy Thickness $\frac{T+t}{2}$	Extra Heavy Width w	Extra Heavy Thickness $\frac{T+t}{2}$	Outside Diameter Maximum* Light	Medium	Heavy	Extra Heavy
0.086 (No. 2)	0.088	0.002	0.011	0.030	0.015	0.035	0.020	0.040	0.025	0.053	0.027	0.165	0.175	0.185	0.211
0.099 (No. 3)	0.102	0.002	0.011	0.035	0.020	0.040	0.025	0.047	0.031	0.062	0.034	0.188	0.198	0.212	0.242
0.112 (No. 4)	0.115	0.003	0.012	0.035	0.020	0.040	0.025	0.047	0.031	0.062	0.034	0.202	0.212	0.226	0.256
0.125 (No. 5)	0.128	0.003	0.012	0.040	0.025	0.047	0.031	0.055	0.040	0.079	0.045	0.225	0.239	0.255	0.303
0.138 (No. 6)	0.141	0.003	0.013	0.040	0.025	0.047	0.031	0.055	0.040	0.079	0.045	0.237	0.251	0.267	0.315
0.164 (No. 8)	0.168	0.004	0.014	0.047	0.031	0.055	0.040	0.062	0.047	0.096	0.057	0.280	0.296	0.310	0.378
0.190 (No. 10)	0.194	0.004	0.015	0.055	0.040	0.062	0.047	0.070	0.056	0.112	0.068	0.323	0.337	0.353	0.437
0.216 (No. 12)	0.221	0.005	0.016	0.062	0.047	0.070	0.056	0.077	0.063	0.130	0.080	0.364	0.380	0.394	0.500
1/4	0.255	0.005	0.017	0.107	0.047	0.109	0.062	0.110	0.077	0.132	0.084	0.489	0.493	0.495	0.539
5/16	0.319	0.006	0.020	0.117	0.056	0.125	0.078	0.130	0.097	0.143	0.108	0.575	0.591	0.601	0.627
3/8	0.382	0.007	0.023	0.136	0.070	0.141	0.094	0.145	0.115	0.170	0.123	0.678	0.688	0.696	0.746
7/16	0.446	0.008	0.026	0.154	0.085	0.156	0.109	0.160	0.133	0.186	0.143	0.780	0.784	0.792	0.844
1/2	0.509	0.009	0.029	0.170	0.099	0.171	0.125	0.176	0.151	0.204	0.162	0.877	0.879	0.889	0.945
9/16	0.573	0.010	0.032	0.186	0.113	0.188	0.141	0.193	0.170	0.223	0.182	0.975	0.979	0.989	1.049
5/18	0.636	0.011	0.035	0.201	0.126	0.203	0.156	0.210	0.189	0.242	0.202	1.082	1.086	1.100	1.164
11/16	0.700	0.012	0.038	0.216	0.138	0.219	0.172	0.227	0.207	0.260	0.221	1.178	1.184	1.200	1.266
3/4	0.763	0.013	0.041	0.233	0.153	0.234	0.188	0.244	0.226	0.279	0.241	1.277	1.279	1.299	1.369
13/16	0.827	0.014	0.044	0.249	0.168	0.250	0.203	0.262	0.246	0.298	0.261	1.375	1.377	1.401	1.473
7/8	0.890	0.015	0.047	0.264	0.179	0.266	0.219	0.281	0.266	0.322	0.285	1.470	1.474	1.504	1.586
15/16	0.954	0.016	0.050	0.277	0.191	0.281	0.234	0.298	0.284	0.345	0.308	1.562	1.570	1.604	1.698
1	1.017	0.017	0.053	0.289	0.202	0.297	0.250	0.319	0.306	0.366	0.330	1.656	1.672	1.716	1.810
1 1/16	1.081	0.018	0.056	0.301	0.213	0.312	0.266	0.338	0.326	0.389	0.352	1.746	1.768	1.820	1.922
1 1/8	1.144	0.019	0.059	0.314	0.224	0.328	0.281	0.356	0.345	0.411	0.375	1.837	1.865	1.921	2.031
1 3/16	1.208	0.020	0.062	0.324	0.234	0.344	0.297	0.373	0.364	0.431	0.396	1.923	1.963	2.021	2.137
1 1/4	1.271	0.021	0.065	0.336	0.244	0.359	0.312	0.393	0.384	0.452	0.417	2.012	2.058	2.126	2.244
1 5/16	1.335	0.022	0.068	0.346	0.254	0.375	0.328	0.410	0.403	0.472	0.438	2.098	2.156	2.226	2.350
1 3/8	1.398	0.023	0.071	0.356	0.264	0.391	0.344	0.427	0.422	0.491	0.458	2.183	2.253	2.325	2.453
1 7/16	1.462	0.024	0.074	0.366	0.273	0.406	0.359	0.442	0.440	0.509	0.478	2.269	2.349	2.421	2.555
1 1/2	1.525	0.025	0.077	0.375	0.282	0.422	0.375	0.458	0.458	0.526	0.496	2.352	2.446	2.518	2.654

Washer Section. Finished washers have a section that is slightly trapezoidal, with thickness at inner periphery greater than thickness at outer periphery.

Designation. Washers are designated by nominal size and series: that is, ¼ in. light, ⅜ in. medium, ½ in. heavy and ¼ in. extra heavy. Washers in certain materials are not available in all four series.

Carbon-Steel Washers. These are available in all four series. They are heat-treated to Rockwell 45-53 C. If made for hot-dip galvanizing, they are coiled to limits 0.020 in. in excess of those tabulated.

Stainless-Steel Washers. These are available in two types of stainless steel, AISI 302 or 420, and light and medium series only. Rockwell hardness, 35-43 C.

Aluminum-Zinc Alloy. Lockwashers are made in medium series only to ASTM B211-47T Specification, Alloy ZG42. They are heat-treated to Rockwell 75-67 B scale, and should have minimum tensile strength of 77,000 psi.

Phosphor-Bronze Washers. Light and medium series lockwashers are available in phosphor bronze conforming to ASTM Specification B159-47T, Grade A. Minimum hardness, Rockwell 90 B.

Silicon-Bronze Washers. Light and medium series are made from ASTM Specification B 99-47, Type B alloy. Hardness, Rockwell 90 B.

K-Monel Washers. These are available in light and medium series in K-Monel corresponding to Federal Specification QQ-N-286 or Navy Specification 46-N-5. Rockwell hardness, 33-40 C; minimum tensile strength, 155,000 psi.

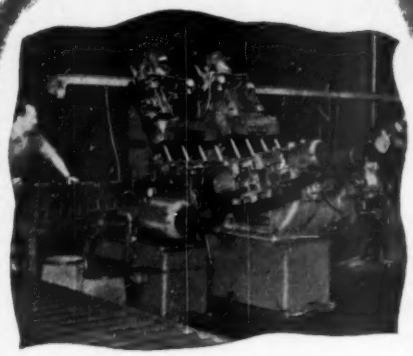
Details of finish, temper testing and twist testing are given in the standard, which is obtainable from the above source.

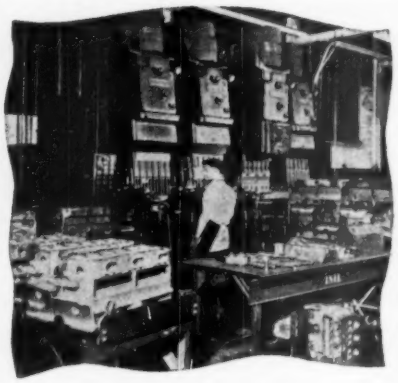
FOOTBURT Production-wise engineers in leading automotive plants are specifying Footburt station type equipment on cylinder blocks, cylinder heads, transmission cases, and other component parts as the most advanced method in quantity manufacturing. Similar operations that ordinarily require several separate machines are grouped in one station machine thus greatly reducing handling and providing better production control. Combining of valve hole operation cylinder boring, the majority of drilling and the majority of tapping are outstanding examples of this latest production trend.

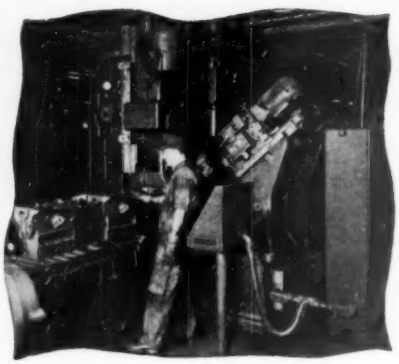
STATION

TYPE

MACHINES







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A TIME TESTED LINE OF MACHINE TOOLS

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Standard Toothed Lockwashers

AMERICAN STANDARD B27.1—1950. PUBLISHED BY THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS, 29 WEST 39TH ST., NEW YORK 18, N. Y. PRICE 75 CENTS

Internal Tooth Lock Washers

Size		#2	#3	#4	#5	#6	#8	#10	#12	1/4	5/16	3/8	7/16	1/2	9/16	5/8	11/16	3/4	13/16	7/8	1	1 1/8	1 1/4
A	Max	0.200	0.232	0.270	0.280	0.295	0.340	0.381	0.410	0.478	0.610	0.692	0.789	0.900	0.985	1.071	1.166	1.245	1.315	1.410	1.637	1.830	1.975
	Min	0.175	0.215	0.255	0.245	0.275	0.325	0.365	0.394	0.460	0.594	0.670	0.740	0.867	0.957	1.045	1.130	1.220	1.290	1.364	1.590	1.799	1.921
B	Max	0.095	0.109	0.123	0.136	0.150	0.176	0.204	0.231	0.267	0.332	0.398	0.464	0.530	0.596	0.663	0.728	0.795	0.861	0.927	1.060	1.192	1.325
	Min	0.089	0.102	0.115	0.129	0.141	0.168	0.195	0.221	0.256	0.320	0.384	0.448	0.512	0.576	0.640	0.704	0.769	0.832	0.894	1.019	1.144	1.275
C	Max	0.015	0.019	0.019	0.021	0.021	0.023	0.025	0.025	0.028	0.034	0.040	0.040	0.045	0.045	0.050	0.050	0.055	0.055	0.060	0.067	0.067	0.067
	Min	0.010	0.012	0.015	0.017	0.017	0.018	0.020	0.020	0.023	0.028	0.032	0.032	0.037	0.037	0.042	0.042	0.047	0.047	0.052	0.059	0.059	0.059

External Tooth Lock Washers

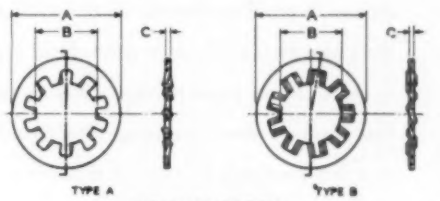
A	Max	.....	.....	0.290	.....	0.320	0.381	0.410	0.475	0.510	0.610	0.694	0.760	0.900	0.985	1.070	1.155	1.260	1.315	1.410	1.630	.....	.....
	Min	.....	.....	0.245	.....	0.305	0.365	0.395	0.460	0.494	0.588	0.670	0.740	0.880	0.960	1.045	1.130	1.220	1.290	1.380	1.590	.....	.....
B	Max	.....	.....	0.123	.....	0.150	0.176	0.204	0.231	0.267	0.332	0.398	0.464	0.530	0.596	0.663	0.728	0.795	0.861	0.927	1.060	.....	.....
	Min	.....	.....	0.115	.....	0.141	0.168	0.195	0.221	0.256	0.320	0.384	0.448	0.513	0.576	0.641	0.704	0.768	0.833	0.897	1.025	.....	.....
C	Max	.....	.....	0.019	.....	0.022	0.023	0.025	0.028	0.028	0.034	0.040	0.040	0.045	0.045	0.050	0.050	0.055	0.055	0.060	0.067	.....	.....
	Min	.....	.....	0.015	.....	0.016	0.018	0.020	0.023	0.023	0.028	0.032	0.032	0.037	0.037	0.042	0.042	0.047	0.047	0.052	0.059	.....	.....

Heavy Internal Tooth Lock Washers

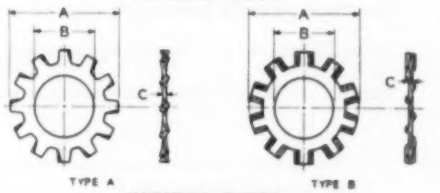
Size		1/4	5/16	3/8	7/16	1/2	9/16	5/8	3/4	7/8
A	Max	0.536	0.607	0.748	0.858	0.924	1.034	1.135	1.265	1.447
	Min	0.500	0.590	0.700	0.800	0.880	0.990	1.100	1.240	1.400
B	Max	0.267	0.332	0.398	0.464	0.530	0.596	0.663	0.795	0.927
	Min	0.256	0.320	0.384	0.448	0.512	0.576	0.640	0.768	0.894
C	Max	0.045	0.050	0.050	0.067	0.067	0.067	0.067	0.084	0.084
	Min	0.035	0.040	0.042	0.050	0.055	0.055	0.059	0.070	0.075

Countersunk External Tooth Lock Washers

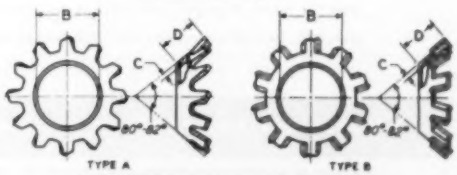
Size		#4	#6	#8	#10	#12	1/4	#16	5/16	3/8	7/16	1/2
B	Max	0.123	0.150	0.177	0.205	0.231	0.267	0.287	0.333	0.398	0.463	0.529
	Min	0.113	0.140	0.167	0.195	0.220	0.255	0.273	0.318	0.383	0.448	0.512
C	Max	0.019	0.021	0.021	0.025	0.025	0.025	0.028	0.028	0.034	0.045	0.045
	Min	0.015	0.017	0.017	0.020	0.020	0.020	0.023	0.023	0.028	0.037	0.037
D	Max	0.065	0.092	0.105	0.099	0.128	0.128	0.147	0.192	0.255	0.270	0.304
	Min	0.050	0.082	0.088	0.083	0.118	0.113	0.137	0.165	0.242	0.260	0.294



INTERNAL TOOTH



EXTERNAL TOOTH



COUNTERSUNK EXTERNAL TOOTH

Manufacturing Detail. The number of teeth, the length of the teeth, the width of the rim and the thickness of the washer over the teeth (free height) shall be optional with the manufacturer, with the provision, however, that the projection of the teeth on both sides of the washer shall be uniform within a tolerance equal to one-half of the projection on one side.

Material and Hardness. Washers shall be made from carbon steel, fabricated and heat-treated to a Rockwell hardness of 40-50 C scale or equivalent. It is recommended, however, that the lighter, more sensitive depth reading Rockwell A scale be used when testing washers of thin section. Decarburization shall be removed before testing hardness.

Finish. Plated washers shall be baked 4hr at 400 F to relieve hydrogen or acid embrittlement. If washers so treated fail to meet the prescribed tests, the baking time and/or the temperature shall be increased.

Designation. Washers shall be specified or designated by the nominal size, description and type, e.g., ¼ in. internal tooth, Type A; 9/16 in. external tooth, Type B; No. 12 internal-external tooth, Type A.

Testing. Specifications for testing these lockwashers are given in the complete standard which is obtainable from the above source.

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ABRASIVE CO.

NUT INSERTED DISCS

for

VERSATILE GRINDING WITH ECONOMY

Maximum grinding contact! That's why Simonds Abrasive Company discs give fast, economical production. The side of the disc is used — grinds large areas quicker. Only usable abrasive charged for. Less machine wear — discs give better balance, reduced vibration and less overhang on shaft and bearings.

Use these versatile production tools on small parts or large areas up to 300 sq. ins. . . . for grinding metals, ceramics and other materials . . . for surfacing, sharpening, squaring, snagging.

Your Simonds distributor can supply you with discs specially made for Hanchett, Gardner, Besly and similar disc grinders. Let's send you his name together with details on grinding wheels for every purpose, and information on our full line of abrasive grains. Write.

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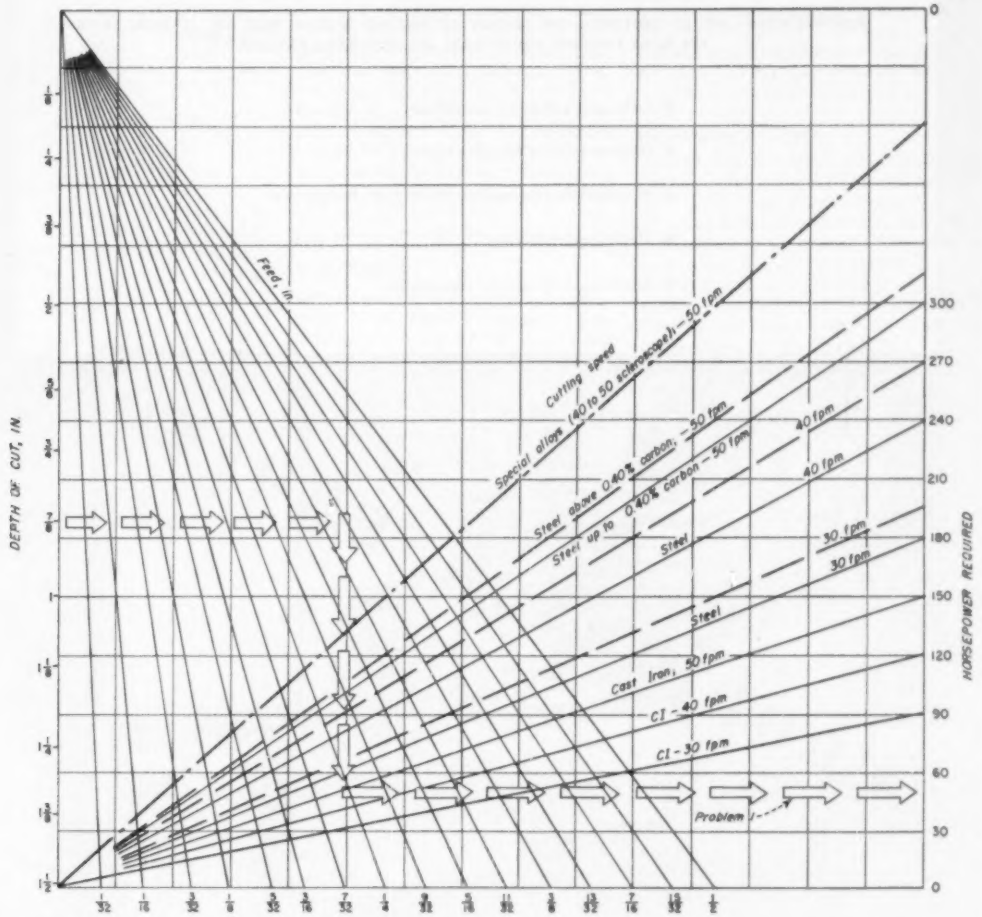
SIMONDS ABRASIVE COMPANY, PHILADELPHIA 37, PA., DISTRIBUTORS IN PRINCIPAL CITIES

DIVISION OF SIMONDS SAW AND STEEL CO., FITCHBURG, MASS. OTHER SIMONDS COMPANIES: SIMON[illegible] STEEL MILLS, LOCKPORT, N.Y., SIMONDS CANADA SAW CO., LTD., MONTREAL, QUE. AND SIMONDS CANADA ABRASIVE CO[illegible]UE.

Power Required for Planing

BY TYLER G. HICKS



The above chart is based on the empirical relation:

$$Hp = 0.0115 \times F \times DC \times CS \times K$$

Where

F = feed in 1/32 in.
DC = number of 1/8ths in. depth of cut
CS = cutting speed, fpm
K = constant: 1 for cast iron; 2 for steel up to 0.40% carbon; 2.25 for steel above 0.40% carbon, and about 2.625 for special alloys of 40 to 50 Scleroscope hardness.

Diagonal lines running upward to the right represent cutting speeds. Some overlapping occurs for curves for steel above and below 0.40% carbon. Hence steel above 0.40% carbon is represented by dash-line curves; steel below 0.40% carbon by solid-line curves. In both instances, these curves are for 50, 40 and 30 fpm.

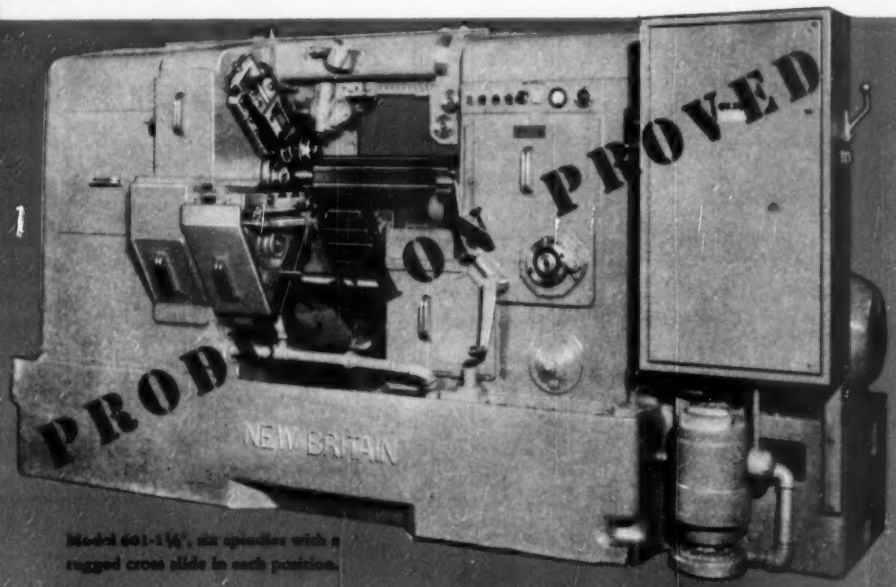
Example 1: What power is required to rough cast iron at 3/4 in. feed, 7/8 in. depth of cut and 50 fpm? By following the arrow trace across chart, the required horsepower is found to be 48.

Example 2: How deep a cut can be taken on steel with a 75-hp planer, the steel having 0.40% carbon, the cutting speed being 30 fpm, and the feed being 15/32 in.? Enter right-hand scale at 75 hp, project left to 30-fpm curve for 0.40% steel, project vertically to 15/32-in. feed curve, project left to depth of cut scale and read 7/8 in.

There's no testimonial like a re-order...

MANUFACTURERS ARE RE-ORDERING NEW BRITAIN AUTOMATICS BECAUSE THEY ARE SATISFIED WITH THE MAIN FEATURES WHICH MAKE AN AUTOMATIC PAY OFF:

- Ease and safety of operation
- Minimum down-time for repair
- Minimum down-time for set-up and change-over
- Flexibility of tooling
- Elimination of second operations



Model 601-1½", six spindles with a rugged cross slide in each position.

N.B.

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Automatics

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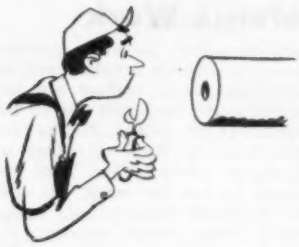
TALKING SHOP



Hole Opener

WHEN an existing hole has to be drilled to a large size, it can be quite a problem. Try this suggestion from Pete Backstrom of Firth Sterling: Take a round piece of carbide of the diameter desired for the hole and grind four flats at one end to produce a truncated pyramid. If the flats are ground true, the drill will follow the existing hole and open it to the required size.

Reminder

A PROMINENT aircraft and engine manufacturer reminds us that the way to hold close tolerances with non-ferrous parts is to make the fixture of material identical with that in the part. In this way, any changes in part or fixture are equalized. Hardened steel or carbide wear pads and bushings should be used, but should not be inter-connected by steel. With present steel or cast-iron tooling, details, designed to locate from a common center, may be made from identical part material. If this material is one of the light metals, fixture handling is greatly simplified.

Shhhh!

WE MENTIONED to an officer of a tool company that we'd been refused information, some time ago, on his outfit's heat-treating practices. He grinned. "That's one thing we don't talk about," he said. "We figure it's too close to our profit-and-loss statement. We won't talk about the metallurgy of our tool steels either. Our machining practice is pretty straightforward; anybody can duplicate it. But some of our alloys include percentages of new elements that give 'em special properties, and the heat-treating is just as tricky. Only a few men know the details of either, and they're not telling."

Reminds us of the company that designed a new product incorporating a special spring. For the prototype, the engineers went across the street to a spring company. The gadget worked, so they went into production—and wound up in trouble with the spring. Inquiry across the street led them to an old heat-treater in one corner. When they asked how he'd made the prototype spring, he grinned and said: "That's my business. Bring over your springs and tell me what you want 'em to do, and I'll make 'em do it. But tell you how? Not on your life!"

Rain Maker

BEFORE the Great Depression, Americans saved $3.40 for every dollar they paid in income taxes. Last year, we saved only 65 cents for each income-tax dollar. The various forms of rainy day the Government now worries about for us thus cost the man who once provided for his own rainy days—whether they're his or his profligate neighbor's.

Mining Twist

MINING TOOLS are one of the major applications of carbide. The drills are short, carbide-tipped, and attached to a section of shank. New shank sections are added as the drill goes deeper. These shanks must be fluted to get the "chips" out and were always twisted from forged bars. Kennametal now twists a scroll from a rolled bar, slips it over a section of pipe and spot-welds it in place. The scroll is then arc-welded to the pipe in a machine that rolls the pipe and scroll as they advance under the welding head. The resulting shank is lighter and cheaper, has ample strength for the job.

Tool Test

OWEN PARMITER of Firth Sterling raises an interesting question: What would happen if we took the same care in sharpening high-speed steel tools that we do with carbide. Carbide tools must be ground properly and finely finished or they may break. But HSS gives fair service with off-hand grinding so there is less incentive for careful work. On a bet, Parmiter took ten Circle C HSS tools, ground them accurately and honed and polished them to a fine finish. All ten then passed the tool breakdown runs on a test log that are given to carbide tools at Firth Sterling. The point is not that HSS is as hard as carbide, or as suitable for many applications, but that the potential life of HSS is often squandered by lack of precision in grinding the tools.

Approximate Copy

READERS TRY OUT ideas we publish, and on occasion write in to say they won't work. Inquiry soon shows that the reader approximated the idea—or modified it to suit his own notions—then blamed the author for failure. Seems to us that if an idea is good enough to copy, the author deserves the courtesy of *exact imitation* before he is condemned.

Ingenuity

IT'S AN AMERICAN characteristic to "improve" on every idea or design, sometimes to such an extent that the original idea is lost. Aircraft engineers will recall tests late in World War II that showed B-24 bombers from three plants were not interchangeable — even major components were modified by the plant. That led to "hangar queens" and wreck stripping. The British, meanwhile, controlled design so closely that most parts of the 4-engine "Lancaster" also fit its 2-engine predecessor, the "Manchester"—and probably fit the "Lincoln" and "York."

Piano-Roll Blues

SEVERAL recent *AM* stories have reported "piano-roll" control of machining operations. We've even seen it described (elsewhere, thank goodness) as a "new" idea. It was with some interest, therefore, that we read in *AM* for Aug. 9, 1939 (p595) that a Sellers lathe equipped with a "player-piano roll" was then contouring wheels for locomotives.

News of Metalworking——

METAL SHOW—The 32nd National Metal Exposition & Congress will be held Oct. 23-27 at Chicago's International Amphitheater. Theme is "Materials and Equipment for High Production." Metals production, treating, and processing will be treated at seminars, lecture sessions, and technical meetings. For more information about the Metal Show, see p161-163, and the big "Show in Print" section, p188.

LAB'S 50th BIRTHDAY—The nation's first industrial research laboratory, the General Electric Research Laboratory, celebrated its 50th anniversary Oct. 9 with formal dedication of its new home in Niskayuna Township near Schenectady. The laboratory plant totals 5 buildings, with a usable area of about 185,000 sq ft.

GERMAN TOOL EXPORTS—West German machine tool exports to western Hemisphere countries in 1950 rose to an average monthly value of 9 million D-marks up to mid-September compared with a monthly average of 2.5 million in 1949.

You Need Special Priority to Get Machine Tools for Defense Work

WASHINGTON — Most important part of NPA regulation II—priorities for essential military orders—to the metalworking industries is its near-complete exclusion of machine tools, any capital expansion, in the "rated" priorities set-up.

The way it is now, neither a prime nor a sub contractor can extend the DO (for "Defense Order") rating of his military contract to get any production machinery or even any spare parts for machinery he already has. He can only extend it to get raw materials and components needed to complete the contract.

At first glance this capital goods aspect of the regulation would appear to to leave much wanting, but it isn't as bad as it seems. In a few special cases it will be possible for either a prime contractor or a subcontractor to get priority deliveries on production equipment.

But he'll need a special priority to do it—designated DO-98. If a contractor who already has a DO-rated military contract — either prime or sub—finds that he cannot possibly meet his delivery schedule without additional tools, chances are the military will issue him one of the special DO-98 ratings. But he will first have to show: (1) that he normally produces the item for which he has the order; (2) that he is already using all his equipment to its utmost capacity; (3) that he has already tried every way short of a priority order to get either new or used equipment to do the job.

Once over these hurdles he can probably get the special order rating, but it's not assured.

• **The exclusion of production** equipment from the priorities setup wasn't an oversight. Here are the two main reasons NPA officials give for it:

(1) There's a good chance capital expansion orders might compete with rated military orders. Regulation II is designed to give essential military orders top billing over less essential civilian production. It has no machinery for rating one essential order against another.

(2) Too many civilian manufacturers anxious to get a share in the expanding military procurement business are trying to convert their production lines from civilian to military production. Trouble is it's happening in lines where there already happens to be plenty of producers to handle all forseeable military orders.

NPA is expected shortly to come out with another regulation to handle important machine tool orders and critical capital expansion projects. It will outline the policies to be followed in rating capital expansions and military orders against each other where they conflict. It will also set up machinery for seeing that only those expansion or conversion projects considered important to the mobilization effort get priorities.

You can count on a system of graduated priorities to come eventually, probably sometime next spring or summer when military production really gets rolling. Meanwhile, other controls will be imposed spottily as needed (see "Washington," p119).

How to Make Sure Manpower Needs of Armed Forces Won't Hurt Production

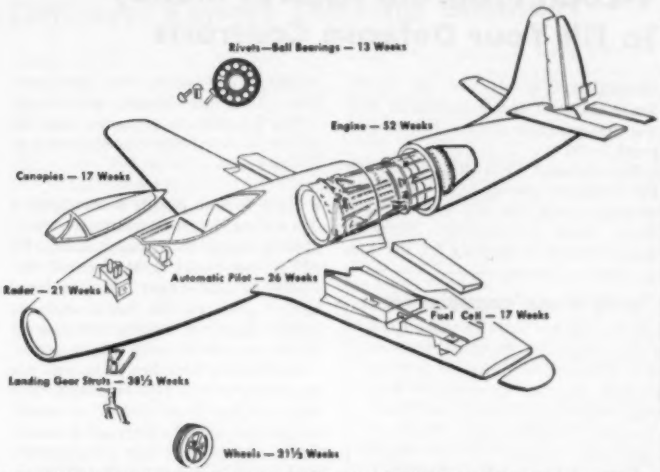
NEW YORK—What steps industry should take to prevent manpower needs of the armed services from crippling their own production forces were outlined by Col. Daniel O. Omer, general counsel, Selective Service System, in an address before the Personnel Conference of the American Management Association here Oct. 3.

While our pool of manpower in the 19- to 25-year-age group is basically adequate for armed force needs, Col. Omer noted, present regulations and policies provide for the deferment of so many men that the actual number now available is not equal to the need. He warned that if this situation forces Selective Service into the older-age groups, it will mean the induction of men with greater skills and more extensive experience, with a much more severe impact upon industry than the loss of younger men.

The speaker particularly emphasized the need for general acceptance of the proposition that men under 26 years of age are to be regarded as available for military service.

• **This advice was then offered** to industry: (1) Do not ask occupational deferment for men under 26, except in the most extreme cases; (2) Utilize, as much as possible, men who cannot meet the physical and mental standards of the armed forces as we knew them in World War II; (3) Plan to keep all men in the age group 26 to 35, inclusive, during the foreseeable future but develop plans which would permit the release of this age group to the armed forces if this nation should be faced with a real fight for survival, and (4) Plan to keep men over 35 indefinitely.

At the AMA luncheon session, the Henry Laurence Gantt Memorial Gold Medal was awarded to Charles R. Hook, Sr., chairman, Armco Steel Corp., for "distinguished achievement in industrial management."


Rivets—Ball Bearings — 13 Weeks
Engine — 52 Weeks
Canopies — 17 Weeks
Radar — 21 Weeks
Automatic Pilot — 26 Weeks
Fuel Cell — 17 Weeks
Landing Gear Struts — 36½ Weeks
Wheels — 21½ Weeks

IT TAKES TIME TO BUILD A MODERN AIRPLANE. Material-procurement time shown here for a few of the parts which go into a plane (time needed for initial shipments from vendor's plant after placement of the order) is being lengthened each month, contributing to Washington's fears that . . .

Rising Costs May Force Cuts in Number of Aircraft to Be Built

WASHINGTON — Rising costs for tooling, labor and other factors may slice the equivalent of 750 F-88 jet fighters from the Air Force's goal of 4,428 new aircraft by 1951. That's how Under Secretary for Air John McCone put it graphically in revealing to a House Armed Services subcommittee that essential materials have increased in cost up to $360,000,000 over original estimates.

Defense authorities are faced, then, with two alternatives: (1) Appropriate more money to cover the ultimate contract price of the airplanes scheduled for procurement in the 1951 fiscal year, or (2) cut the quantity of planes to be ordered.

• **Planes are being turned out** today by some 60 airframe, engine and propeller plants of varying sizes. Few additional aircraft plants will be opened. Total space available in those 60 plants is approximately 70 million sq ft, of which some 60 million are used to build aeronautical products.

Currently available in the U. S. war plant reserve program are 468 plants of which 75 are available for aircraft production. These 75 plants, which initially cost more than a billion dollars, are divided into two categories: the military establishment plant reserve of 36 plants and the national industrial plant reserve of 39 plants. The former are wholly owned or controlled by the military departments and include plants in use or held in a standby condition. The 39 plants in the national industrial plant reserve are plants that have been sold or leased with a recapture clause in the contract making them available for immediate return to national defense production, or are surplus plants maintained in a standby condition.

• **Biggest expansion programs** will be seen at Seattle and Wichita plants of Boeing, at Convair's San Diego and Fort Worth plants, and at the Los Angeles-aren plants of Lockheed, Douglas and North American.

All of these plants will need additional tooling, and substantial orders have been placed already with machine tool builders. Some equipment has been withdrawn from the government's machine tool reserve which at the outbreak of hostilities in Korea contained more than 161,000 general-purpose machine tools.

Major Defense Contracts

AIR FORCE

Douglas Aircraft Co., Inc., Santa Monica, Calif., spare parts for aircraft, $9,400,000.

Wright-Aeronautical Corp., Div. of Curtiss-Wright Corp., Wood-Ridge, N. J., spare parts for R-3350 engines, $4,942,645.

Fairchild Aircraft Div., Fairchild Engine & Airplane Corp., Hagerstown, Md., misc. assemblies, sub-assemblies and spare parts, $1,840,919.

Dixon Mfg. Co., Inc., Coffeyville, Kans., misc. assembly, sub-assemblies, kits and spare parts, $350,000.

Bendix Products Div., Bendix Aviation Corp., South Bend, Ind., brakes & related spare parts, $229,099.

Goodyear Tire & Rubber Co., Akron, Ohio, wheels & brakes, $129,469.

Eclipse Pioneer Div., Bendix Aviation Corp., Teterboro, N. J., components of automatic pilot, $132,687.

General Electric Co., Schenectady, N. Y., spare parts for J47 turbojet engines, $255,424.

Lockheed Aircraft Corp., Burbank, Corp., Calif., 54 mid-span, wing pylon kits, $100,000.

B. F. Goodrich Co., Akron, Ohio, misc. deicer shoes for aircraft, $1,278,558.

North American Aviation, Inc., Los Angeles, Calif., misc. assemblies, sub-assemblies, kits and spare parts, $1,281,152.

Ryan Aeronautical Co., San Diego, Calif., misc. assemblies, sub-assemblies, and spare parts, $339,000.

Cleveland Pneumatic Tool Co., Cleveland, misc. spare parts, $105,113.

Canadian Commercial Corp., Montreal, spare parts for C-47 & C-54 aircraft, $891,339.

Timken Roller Bearing Co., Canton, Ohio, roller bearings, $116,045.

NAVY

Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. J., P-1 automatic pilot components: servo No. 1, $1,905,265; transmitter, fuel flow-meter, $648,207.

Westinghouse Electric Corp., Philadelphia, torque tube assemblies, $186,376.

Bendix Products Div., Bendix Aviation Corp., South Bend, Ind., diaphragm assemblies, $393,162.

Fairbanks, Morse & Co., Chicago, various repair parts for diesel engines, $642,120.

Cleveland Diesel Engine Div., General Motor Corp., Washington, D. C., vapor compressors, $100,000.

Sperry Gyroscope Div., Sperry Corp., Great Neck, L. I., N. Y., electron tubes, $193,800.

ARMY

Breese Burners, Inc., Santa Fe., N. M., burners, oil stove, $399,900.

Acme Steel Co., Chicago, flat steel strapping, $154,593.

Brainard Steel Co., Warren, Ohio, flat steel strapping and strapping seals, $202,250.

Production Engineering & Mfg. Co., St. Louis Mo., conversion kit for converting 60 mm mortar M2 to 60 mm M19, $239,075.

Kellogg Switchboard & Supply Co., Chicago, telephone switchboards and maintenance parts, $150,000.

Western Electric Co., Inc., New York, telephone terminals and maintenance parts, $1,225,500.

J. H. Nolan Corp., Cleveland, V-17 MTQ trucks, $400,000.

Johnson Service Co., Milwaukee, radiosonde, $100,000.

Price Instrument Div., Bendix Aviation Corp., Towson, Md., radiosonde, $300,000.

Federal Telephone & Radio Corp., Clifton, N. J., switchboards, $400,000.

Kleinschmidt Labs., Deerfield, Ill., teletypewriters, $800,000.

Hallicrafters Co., Chicago, radio sets, $300,000.

Molded Insulation Co., Philadelphia, radiosonde, $250,000.

Johnson Service Co., Milwaukee, radiosonde modulators, $304,400.

Collins Radio Co., Cedar Rapids, Iowa, radio sets, $728,000.

Willys-Overland Motors, Inc., Toledo, axle shafts, $129,035.

Jos. Weidenhoff & Co., Chicago, magneto & distributor testers, $269,024.

Copperweld Steel Co., Warren, Ohio, steel class 6, $140,527.

Republic Steel Corp., Cleveland, barrel blanks, $256,518.

Parker Mfg. Co., Worcester, Mass., extractors, $332,500.

United Surgical Supplies Co., New York, surgical instrument kits, $486,500.

Tool & Die Men to Meet

CLEVELAND—The National Tool & Die Manufacturers Assn. will hold its fifth annual national convention at the Hotel Statler here Oct. 29-Nov. 1. Theme of the meeting will be planning for fast, effective mobilization of facilities to supply the tooling and special machinery needed for all-out defense production. Reports will be made on the Mobilization Planning Survey which the Association is now conducting.

V-Loan Program Assures Money To Fill Your Defense Contracts

WASHINGTON—If you get a defense contract the government will see that you also get the money you need to fill it.

The Defense Production Act gave the President power to set up a loan program with the sky as the limit. Since then government agencies have worked feverishly on the machinery for passing out the cash. Some loans have already been made.

The program is going to seem familiar; it resembles the one used in the last war.

• **Here is how it will work:** Take a metalworking manufacturer with a $300-thousand government order. To fill it, he needs $100-thousand for materials and wages. But his local banks, knowing his assets and his credit standing, thinks his line of credit should be only $25-thousand.

The man's best bet is to ask his bank for the full $100-thousand. The local lender then makes an application for a 75% guarantee under the government V-loan program for short-term working capital. The application is filed with a Federal Reserve district bank, which forwards it to Washington.

While waiting for an okay, the district bank checks the borrower's credit. Meanwhile in Washington, the Federal Reserve Board shoots the request over to a certifying officer at the Pentagon, getting approval in a matter of hours in most cases The district bank is notified by teletype, the local bank by phone, and the cash is made available on the spot.

Now suppose the manufacturer has a $3-million order, and needs a $1-million loan for new plant as well as working capital. This would probably be too big for the V-loan program. So the contractor would have to turn to the procurement office he's dealing with for help.

• **In World War II** he would have been sent right to the Reconstruction Finance Corp. for a direct loan. This time government agencies would rather see a contractor get one or more of the other kinds of aid provided in the defense act:

Advance payments for prime contractors.

A deal to buy a percentage of output, with cash advanced against deliveries.

General Services lease of machinery out of its reserves.

Accelerated amortization to write off new plant.

If this won't get him the aid he needs, RFC stands ready to put up long-term cash.

We believe in the "many in one" campaign idea

THIS YEAR, Community Chests are uniting more than 15,000 health and welfare agencies in one big effort to raise approximately $190,000,000. This is to help finance such typical Red Feather services as Boy Scouts and Girl Scouts, Maternity Homes, and Visiting Nurses, Family Service, Travelers Aid, Neighborhood Houses and Legal Aid. Included too are Boys' Clubs and Camp Fire Girls, Urban League, Children's Aid, Hospitals and Clinics, and Services for the Aged. The Salvation Army, YMCA, YWCA, Summer Camps, Clubs for Girls, Aid to the Handicapped and Social Hygiene services are also members of the Red Feather family.

Being businessmen we see the advantage of uniting these many campaigns under one efficient, fund-raising organization. Industry *knows* that production costs drop as volume increases. Over 30 years' Chest experience *proves* that coordinated campaigns cost less, save time and energy and raise more money to provide more and better services. Big or small, federated campaigns guarantee effective use of the funds subscribed. They substitute order for the chaos that comes with many separate fund-raising efforts.

Proof that the "many in one campaign" is effective lies in the fact that appeals are being federated in more and more local communities. Leaders of both management and labor, in civic clubs and governmental departments, from professional circles and educational groups are giving increasing endorsement to the idea of joint campaigning and budgeting.

The number of communities organizing Chests has steadily increased. In 1940 there were 561 reported Chests. By 1948 the number had grown to 1060. At the present time definite information is available about Chests in more than 1250 cities.

Federated drives raise more money for the participating agencies than they raise separately. No city has ever reported that it raised *less* money for its needed services in a federated campaign than the agencies secured independently in separate appeals. On the contrary, seven cities holding their first Community Chest campaigns last year, actually raised an average of 87.3 percent more than the health and welfare agencies had raised in previous years by individual efforts. This successful 1949 experience with first Community Chest campaigns has been duplicated in hundreds of communities over the 37-year history of Community Chests.

United campaigns are wisely planned, cooperative undertakings. We believe they make sense and should be supported generously by all thoughtful businessmen.

Charles E. Wilson, National Campaign Chairman
Community Chests of America
(President, General Electric Company)

Charles E. Wilson, Vice-Chairman
Community Chest of America
(President, General Motors Corporation)

Machine Tool Distributors Elect Officers; Report Thriving Business

LAKE PLACID, N. Y.—Earl B. MacDonald, vice president, Syracuse Supply Co., Syracuse, N. Y., was elected president of the American Machine Tool Distributors' Association at the 26th annual meeting, held at the Lake Placid Club, Sept. 29-30.

Edgar J. Seifreat, president, Seifreat-Elstad Machinery Co., Dayton, Ohio, was named first vice president, and John M. Riordan, Riordan Machinery Co., Detroit, became second vice president. George B. McClellen, Delta Equipment Co., Philadelphia, was reelected sect.-treasurer.

Directors for three-year terms are: Arlington Neutzel, Blackman & Neutzel Machinery Co., St. Louis; Thomas Rudel, Rudel Machinery Co., New York; and Thomas M. Rees, Rees Machinery Co., Pittsburgh. Frederick A. Brechter, vice president, VanDyck Churchill Co., New York, was elected director for one year.

Almost all members in attendance reported a thriving business, though little of it has come from the defense program. Within the last few weeks, however, a sizable trickle of defense orders has been noticeable in some areas, with ordnance contracts as the source.

• **In selling machine tools,** distributors should use the tools of industrial engineering, Alan H. Morgensen, Work Simplification Conferences, Lake Placid, N. Y., told members. He strongly advocated elimination of waste motion in metalworking shops. He urged that workers be taught to use both hands productively instead of one hand. They should do so in such a manner as to require no more physical effort than at present. Every salesman should remember that people resent change and resent criticism and should shape his sales story and sales approach accordingly.

Robert L. Giebel, president, Giebel Inc., New York, talked on "New Machinery for Old." No decision has yet been made as to whether to offer refresher courses for machine tool salesmen in the summer of 1951, Frank L. Armstrong, Marshall & Huschart Machinery Co., Chicago, reported as chairman of the Association's Sales and Service Committee.

Dan Harrington, general manager, Harrington-Wilson-Brown Co., New York, described the information needed to quote on a new machinery when a salesman is originating an inquiry.

E. B. MacDonald, new president of American Machine Tool Distributors' Assn.

Outgoing President O. W. Johaning, president of Colcord-Wright Machinery & Supply Co., St. Louis, presided at the 26th annual meeting of AMTDA

Metal Trades Discuss Operations in Present Crisis

NEW YORK—Business gets no guaranty from the Defense Produtcion Act of 1950 that satisfactory wage controls will accompany institution of price controls, members of the National Metal Trades Association were told by David R. Clarke, general counsel of the association. He spoke at the 51st annual convention here Sept. 27-29.

Mr. Clarke was one of several speakers who spoke on topics under the convention theme of, "Guideposts to Industrial Operations in the Present Crisis."

• **On the subject of controls,** James P. Selvage of Selvage & Lee, public relations counsel, warned that industry must be on its guard against unnecessary controls which have their base in "long-range socialistic planning offered under the patriotic cloak of war emergency."

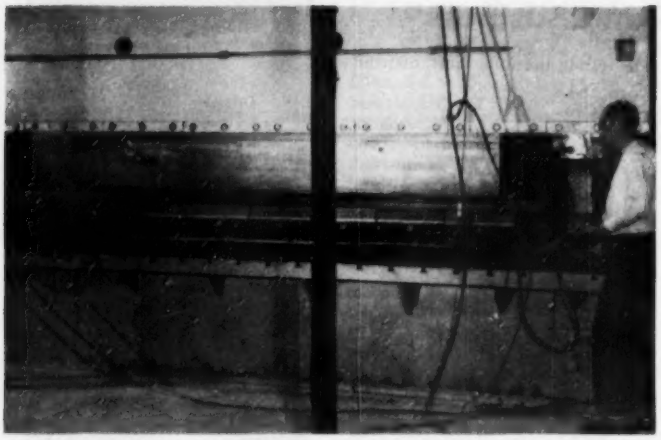
These "Throttling Effects of Socialism" were described in a talk under that title by Alfred Edwards, a former Labor member of Parliament, who declared that there was not one piece of socialist legislation that has been passed in England that has not been an absolute failure.

Maj. Gen. Lewis B. Hershey told the gatheirng that it was best for the military department to make more intensive use of men in younger age brackets, and urged the trade to support this view, partly to prevent dissipation of skilled workers. He favored building an armed force of 3 million men, and believed military training should be given to every man up to 25 years of age for at least two years.

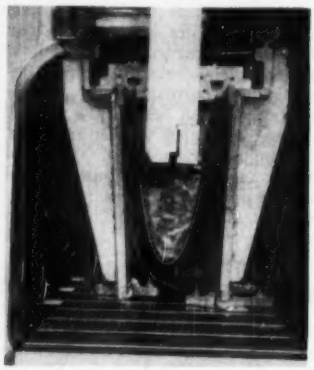
• **The return of women** to the shops will be necessary as the manpower shortage becomes more critical, it was indicated by F. S. Laffer, training director of Cleveland Graphite Bronze Co. He outlined a three-point program for utilizing women in industry: (1) Get all who have worked before; (2) Get a new group of women to replace those who cannot return; (3) Train women to higher skills than they had before. Plants will not be able to afford as many setup men as before, he explained, so women will have to be trained to do this work.

"The most important task in industrial management today is to provide human leadership," Kenneth G. Yost, director of industrial education for the association, declared. "There's no way we can get men to follow us unless they have faith and confidence in management. It takes something more than position and authority," he said.

Joseph L. Kopf, president, Jabez Burns & Co., New York, was elected president of the NMTA, succeeding T. J. Morton, Jr., president of Hoosier Cardinal Corp., Evansville, Ind. P. M. Morgan, president of Morgan Construction Co., Worcester, Mass., was elected first vice president, and Charles S. Craigmile, president of Belden Mfg. Co., Chicago, was named second vice president and treasurer.



Two hinged members, each carrying a row of pneumatic clamps 16 in. long, are fastened to a base that is bolted to machine bed



For some operations the sheet edges are preformed (left), and the jaws so placed that the stock will be drawn over radius bars to ease the stress on the metal. Right—For other jobs, radius bars are not used, and the jaws are disposed for a straight pull on the metal

Stretch-Press Work Performed On a Standard Press Brake

LOS ANGELES—Aircraft-wing and tail-leading-edge skins are now being formed by the stretch-press method on a standard press brake by Northrop Aircraft, Inc., Hawthorne, Calif. Conversion of the press brake to this purpose does not impair normal operation of the machine, and costs about one-tenth as much as a stretch press, it is claimed.

Northrop tool engineers developed the accessory equipment, when in urgent need of a method for forming skins for the firm's F-89A jet interceptor. If conventional bumping of sheet aluminum to templet contours had been used, the time per skin would have been from 8 to 10 hr. But by coupling the stretch-press method to the characteristics of a hydraulic press brake, a wing skin is formed in 2 to 3 min. to a tolerance of 0.005 in.

• **The setup** consists of a 400-ton brake (boosted to 600-ton capacity) and two hinged members fastened to the bedplate. These members are each fitted with a row of 16-in. long jaws incorporating pneumatic clamps. The jaws are designed to grip material up to 0.25 in. thick.

At the control station, the operator sets a gage for punch travel, and limit witches then control ram descent within 0.002 in. A skin with burr-free edges and preformed for engagement with the clamps is inserted in the jaws. Now the operator manipulates a valve that applies clamping pressure to the jaws. Punch descent is controlled with a foot switch. While the ram descends, the operator operates a switch that controls an electric hoist. By means of a chain attached to the hinged members, these are pulled upward to the closed position as the ram descends, thus wrapping the skin around the punch.

The stock is normally stretched 5 to 6%, which means that a part measuring 40 in. jaw to jaw will be subjected to a 1- to 1.2-in. stroke by the punch after the skin is drawn tight around the die. More stretch, according to Northrop engineers, results in strain lines, while less does not set the shape to the punch.

Experience indicates several points that should be watched in applying the stretch-press method. First, the blank must be deburred because any scratches or nicks may give rise to tears. Second, each jaw must grip the sheet with at least one-half of the jaw segments. If this rule is not observed, the jaw may grip ahead of an adjacent jaw, resulting in localized stretching and tearing.

The sheet should be in the "as-quenched" or "icebox" condition to gain the best characteristics for stretch forming. Ordinary lubricating oil is used on the stock.

Cincinnati Milling Expands Operations

CINCINNATI — Three expansion programs have been announced by Cincinnati Milling Machine Co.

Carlisle Chemical Works, Inc., a subsidiary, is moving into its new plant at Reading, Ohio.

A new division—Cincinnati Milling Products Div.—is now selling the new Cincinnati grinding wheels as well as Cimcool cutting fluid. Both products are made in a plant completed in May 1, 1949, and now being enlarged.

The increased line of machine tools has created tight spots in floor space of Cincinnati Milling's main plants, so the company has decided to build a new plant within easy reach, on a site just outside Wilmington, Ohio.

Charles W. Frick

James P. Kinney

C. Eugene Moore

Joseph A. Horne

Names in the News

Charles W. Frick has been named works manager, Propeller Div., Curtiss-Wright Corp., Caldwell, N. J. **George E. Savaria,** former superintendent of machine shops and assemblies, was named superintendent of steel blade manufacturing succeeding the late **Russell Richardson. Warren P. Cross** was elevated to superintendent of machine shops and assemblies, and **Harold B. Snyder** succeeds Mr. Cross as superintendent of production machine shops. Before joining Curtiss-Wright, Mr. Frick was affiliated with Ford Motor Co. and the Kaiser-Frazer organization.

William H. Staples, vice president and general manager of Cleveland Hobbing Machine Co. since 1926, has been elected president to fill the unexpired term of the late **Harvey H. Brown,** who died Aug. 11.

Fred P. Biggs has been appointed president, Brake Shoe & Castings Div., American Brake Shoe Co., New York. **Stephen S. Conway** has been named vice president in charge of sales, Brake Shoe & Castings and Southern Wheel Division.

James P. Kinney, former partner in Gordon & Kinney, Inc., Detroit, has been named general sales manager, Philadelphia Div., Yale & Towne Mfg. Co., New York. He succeeds **Samuel W. Gibb,** resigned. **C. Eugene Moore,** formerly assistant to plant manager of Electro-Motive Div., General Motors Corp., has been named works manager, a new post. **John T. McCarley** with Yale & Towne since 1936, has been named manager of production, a new post. **Bruno A. Moski,** formerly resident field engineer at the Philadelphia Div. representing the George H. Elliott Co., consulting engineering firm, has been named chief industrial engineer, a new post. **Richard H. Diesel** has been named director of purchasing of the Stamford Div., suceeding **A. B. Nordin, Jr.,** resigned.

William A. Bohlander has been named factory manager, Hydraulic Press Mfg. Co., Mt. Gilead, Ohio. He was previously associated with Aetna Standard Engineering Co. as superintendent and spent 18 years as master mechanic, maintenance, Jones & Laughlin Steel Corp.

OBITUARIES

Joseph A. Horne, 82, board chairman since 1943 of Yale & Towne Mfg. Co., New York, died Oct. 3. He joined Yale & Towne in 1892 as a foreman.

Ernest S. McClary, secretary and treasurer of E. W. Bliss Co., Toledo, died Sept. 23. He had been with Bliss for 17 years.

William R. Reid, 71, board chairman of Torrington Co., Torrington, Conn., died Sept. 16. He had been with Torrington for 50 years, 22 years as president. He became chairman four years ago.

J. R. Munro, general factory manager, has been named to the newly-created position of director of manufacturing, Caterpillar Tractor Co., Peoria, Ill. **C. A. Woodley** has been named general factory manager; **W. L. Naumann** and **Lloyd J. Ely** have been named assistant general factory managers.

Fred P. Biggs

Stephen S. Conway

William A. Bohlander

J. R. Munro

SHOW IN PRINT

Products shown in this section have not been described previously in our pages. They will be exhibited at the National Metal Congress and Exposition, International Amphitheatre, Chicago, October 23 to 27

Hydraulic Bolster for Presses Allows Completed Stroke at Overload

The picture shows a Verson hydraulic bolster mounted on the bed of a 350-ton single-crank press. The hydraulic pumping unit, oil pot, relief valve, and pressure gage comprise a compact assembly which is mounted on the right-hand column of the press. The unit maintains a constant preset oil pressure.

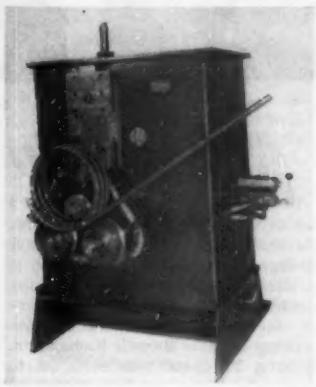
The bolster is actually an overload cushion which can be set at any desired tonnage, usually 10 to 15% over the tonnage required by the work being performed. If, for any reason, the set tonnage is exceeded, the release valve operates to depress the bolster, allowing the ram of the press to complete its stroke without damage to press or dies. It is especially well adapted for use in coining, embossing, or bottoming operations, where there is danger of accidental overloading.

Verson Allsteel Press Co., 1355 E. 93rd St., Chicago 19, Ill. **Booth 122**
(MORE DATA? CIRCLE FYI 31, p. 197)

Hole Starter and Center Punch Avoids Breakage Due to "Walking"

This tool is designed for use with hard-steel drills to avoid breakage because of walking on ground or curved surfaces, also to provide more accurate location of the hole. It may also be used as a center punch for layout work in soft or hard materials. It needs only a one-hand operation. Adjustable spring tension permits ease and accuracy of layout. It has a replaceable point.

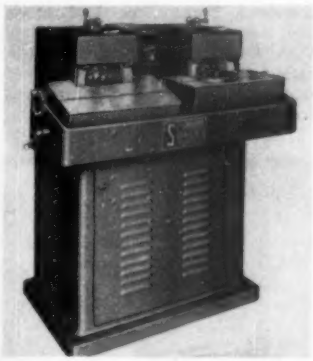
Black Drill Co., 1400 East 222nd Street, Cleveland 17, Ohio. **Booth 722**
(MORE DATA? CIRCLE FYI 32, p. 197)



Wallace Rolling Machine Will Bend Pipe, Tubes, or Bars

This rolling machine is operated by hydraulic control valve—no manual operation is necessary after initial setup. All rolls are operated in either a right- or left-hand direction. Will repetitively roll to diameter specifications on production runs.

Wallace Supplies Mfg. Co., 1300 Diversey Parkway, Chicago. **Booth 114**
(MORE DATA? CIRCLE FYI 33, p. 197)



Tables Tilt to Desired Angle In Twin-Wheel Tool Grinder

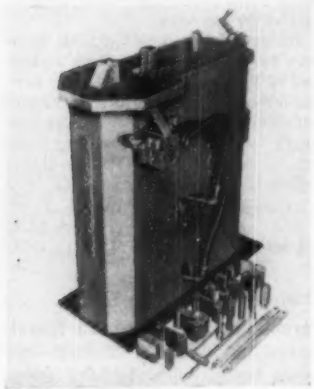
The parallel-spindle design of these grinders saves floor space since the

grinder may be located against the wall. The stationary tables are said to assure precision grinding; they tilt to the angle required, but the tables do not move.

The crank handle at the top turns to bring the wheel forward toward the table for minimum clearance as the wheel wears. The splined-spindle-quill construction permits this adjustment, and at the same time maintains belt alignment.

The Standard Electrical Tool Co., 2483-96 River Road, Cincinnati 4, Ohio. **Booth 2102**

(MORE DATA? CIRCLE FYI 34, p. 197)



Richard Multiform Bender can be Operated Manually, or by Air

An improved model of the Multiform bender has been produced by Richards. It will bend heavier and wider steel, it has more power, an improved toggle mechanism, and hardened insert bushings. An air cylinder may be mounted in the steel cabinet for automatic operation.

J. A. Richards Co., Kalamazoo 60F, Mich. **Booth 1914**

(MORE DATA? CIRCLE FYI 35, p. 197)

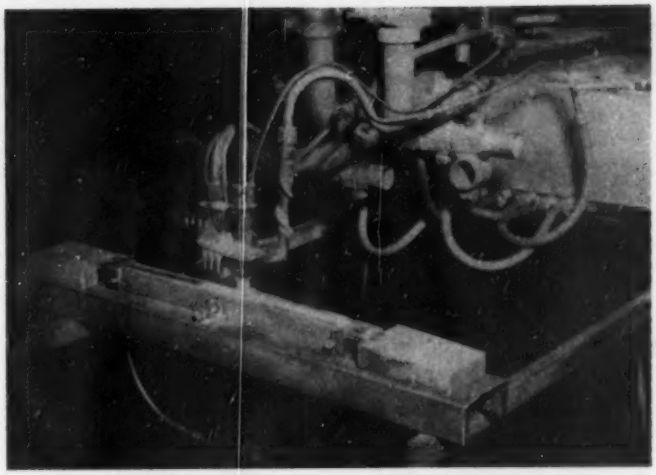
Current Passes Through Cable Instead of Electrode Holder Parts

The limiting factor in volume of current which can be sent through electrode holders is the resistant heat produced. A workman's hand can only endure a limited amount while manipulating the holder.

It is said the problem has been solved by the improved Shortstub electrode holder. It is designed so that the welding current is not conducted through the holder, but through a cable which connects directly to the end of the electrode.

Bernard Welding Equipment Co., Chicago 19, Ill. **Booth 2638**

(MORE DATA? CIRCLE FYI 36, p. 197)



Hard-Facing of Wearing Parts Put on Production Basis

Mechanized hard-facing is a process developed by Haynes-Stellite for applying a protective coating to wearing parts on a production basis. The development is said to have these advantages over hard-facing by the usual hand-torch methods: It is faster, the deposits produced are smoother and more uniform, and less hard-facing rod is required per piece surfaced.

Three Methods Developed

Up until now, three mechanized hard-facing methods have been developed. One employs a straight-line unit used to deposit hard-facing material on long, flat parts, such as plastic cutting knives. In operation, the carriage carrying the welding heads and rod travels along the tracks and parallels the workpiece. The number of parts that can be surfaced at one time is limited only by the length of track available or the length of the workbench holding the parts.

The setup for handling circular pieces is similar, except that the part to be surfaced is mounted on an adjustable-speed turntable. The part moves under the flames while the carriage holding the multiflame heads remains stationary.

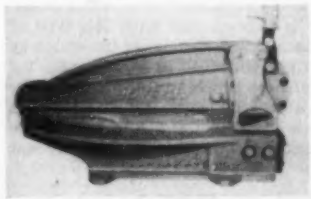
The third machine developed is for surfaces like pump rods, sleeves, bushings, and crushing rolls to be used in the oil and food processing industries.

When to Mechanize

Mechanized hard-facing is especially suitable for large quantities of parts similar in size and shape. It is not suitable for complex parts where not more than two or three pieces would be surfaced per week, mainly because the cost of setting up would not be warranted by the production requirements.

Haynes Stellite Division, Union Carbide and Carbon Corp., 30 E. 42nd St., New York 17, N. Y. **Booth 901**

(MORE DATA? CIRCLE FYI 37, p. 197)



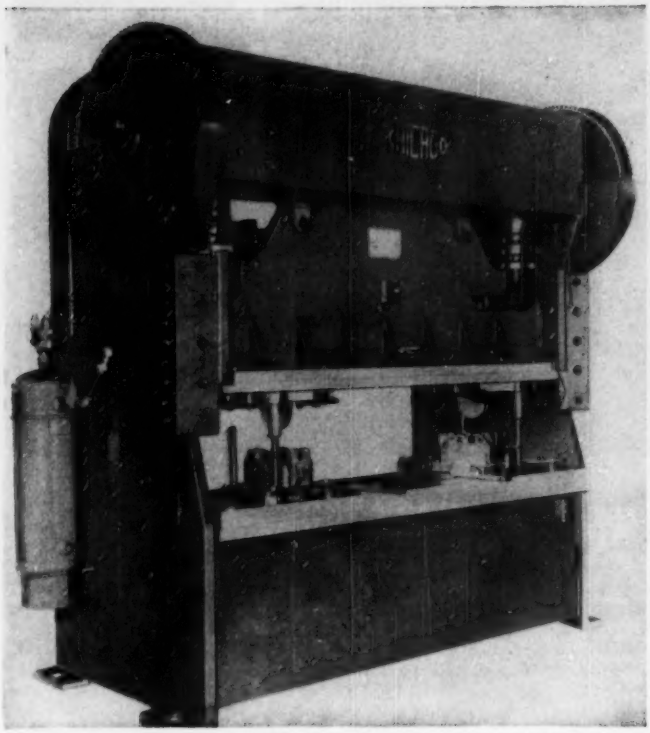
Four Lower Blades Form Die In Beverly Inside Slotter

Designed for fast cutting and slotting up to 8 in. in size, this deep-throat inside slotter handles metals up to and including 16 gage. Four lower blades, arranged in a rectangle, form a die to support and assist the upper blade as it cuts down through the metal. Continuous cuts, during which work may be pivoted at any point in the stroke, are possible.

A 2½x⅛-in.-wide slot may be cut at one stroke. Price for complete unit—$85.

Beverly Shear Mfg. Co., 3004 W. 111th Chicago 43, Ill. **Booth 2623**

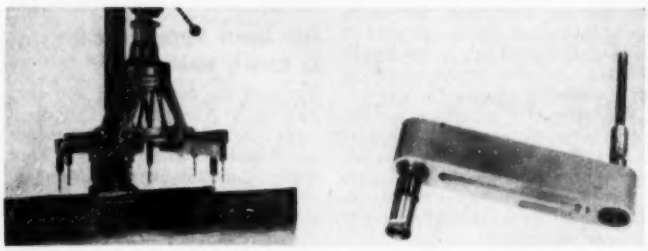
(MORE DATA? CIRCLE FYI 38, p. 197)



Standard Press-Brake Parts Used in Straight-Side Press

It is claimed that until this type of machine was developed the only way to get wide bed and ram areas for multiple punching and blanking jobs was in a large straight-side press. In this adaptation, standard press-brake parts and controls are used wherever possible at a saving in cost. A wide bed arrangement will hold the ram in perfect alignment under off-center loading or concentrated loading.

Dreis & Krump Mfg. Co., 74th St. and Loomis Blvd., Chicago. **Booth 1620**
(MORE DATA? CIRCLE FYI 40, p. 197)



Extension Spindles on Multi-Drill Increase Maximum Drilling Area

An accessory has been added to the Multi-Drill, the attachment which permits the drilling or tapping of from 2 to 8 holes at one stroke of a drill press. This accessory increases the maximum drilling area of the multi-drill from a 9 to a 22½ in. bolt circle. Extension spindles do the trick—they are interchangeable with standard spindles.

The Commander Mfg. Co., 4225 W. Kinzie St., Chicago. **Booth 462**
(MORE DATA? CIRCLE FYI 41, P. 197)

Tank-Turning Rolls Equipped With Roller Chain, Rubber-Tread Shoes

Aronson "Trac Tred" turning rolls are said to be able to rotate light-gage tanks without the use of stiffener rings to prevent the walls from collapsing during rotation. Better holding characteristics are accomplished through the use of rubber tread shoes under the entire bottom surface of the tank.

Speeds are infinitely variable, from zero to 100 ipm. Jackscrews at the end of the power unit and idler permit adjustment of the center distance between the sprockets until they are tangent to the center roll. Bearings are anti-friction ball or Timken taper roller.

Aronson Machine Co., Arcade, N. Y. **Booth 2427**
(MORE DATA? CIRCLE FYI 42, p. 197)

Electronic Controls in Tester Permit Constant Crosshead Travel

Riehle has added a 30,000-lb capacity testing machine to their electronic-control line. A Pendomatic indicating unit eliminates loose balancing weights and wrong combinations. An accuracy of ½ of 1% of indicated load is claimed. Floor level mounting requires no special foundation or fastening. Low table height of the machine affords greater convenience. Automatic backlash eliminators prevent transfer of crosshead weight.

Riehle Testing Machines, Div. American Machine and Metals, Inc. East Moline, Ill. **Booth 2025**
(MORE DATA? CIRCLE FYI 43, p. 197)

Portable Electronic Instrument Sorts Steel Magnetically

A portable electronic instrument developed by Fisher distinguishes between steel sections of the same physical dimensions by measuring their magnetic properties. Properties influenced not only by chemical composition, but also by working and temperature treatment.

Known as the Steelsorter, the instrument eliminates the need for chemical analysis of each piece. The method used is said to be rapid and non-destructive.

Fisher Scienttific Co., Pittsburgh 19, Pa. **Booth 2753**
(MORE DATA? CIRCLE FYI 44, p. 197)

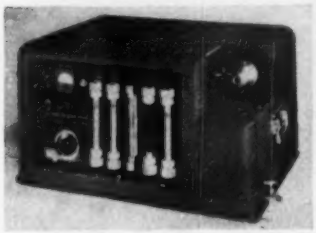
Black Body, Actual Temperatures Read Simultaneously on Pyrometer

The Pyro Bi-Optical Pyrometer is a direct-reading instrument based on the use of light filters and color wedges which are transparent to a number of colors simultaneously.

By using filters with a number of transparencies both for separation and for mixing and toning down, the instrument is capable of measuring black body and actual temperatures simultaneously. It is furnished with scale ranges from about 950 to 2000 C or 1800 to 3600 F.

The Pyrometer Instrument Co., Inc., Bergenfield, N. J. **Booth 302**

(MORE DATA? CIRCLE FYI 45, p. 197)



Induction-Heater Measures Carbon Content in Steels

This automatic high-frequency induction heater makes possible rapid and accurate carbon determinations in all kinds of ferrous materials, from steels with low carbon content to stainless steels and cast irons. It may also be used for both gravimetric and volumetric analysis. It produces temperatures in excess of 3000 F, and has a built-in purification train. A factor weight of 2.727 grams can be accommodated.

Fisher Scientific Co., Pittsburgh 19, Pa. **Booth 2753**

(MORE DATA? CIRCLE FYI 46, p. 197)

American Brass Produces Continuous Coils Weighing 2400 Lb

American Brass has developed a process for making highly finished, non-welded brass coils, heavier and having closer tolerances than previously produced.

The finished coils can be made up to 24 in. in width, with weights of 100-lb per in. of width. They are claimed to be finished to the closest standard-gage tolerances, and said to have an extremely fine surface finish.

Anaconda Copper Mining Co., 25 Broadway, New York. **Booth 2002**

(MORE DATA? CIRCLE FYI 47, p. 197)

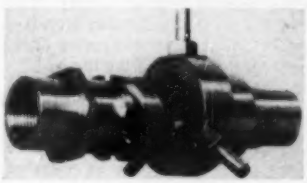
Nelson Power Source Welds Studs up to 3/4 in. in Diameter

This Nelson motor-operated generator set is capable of welding studs up to and including ¾ in. in diameter. Its performance is said to be equivalent to two conventional 400-amp generators in parallel. Either 220-volt, or 440-volt, 60-cycle ac can be used with the power unit, which weighs approximately 700 lb, and is comparable in size to a 220-amp welding generator.

Nelson has also developed a battery-operated unit which can be used for installing studs up to ½ in. in diameter, where only 110-volt ac current is available. The unit includes twelve 150-amp wet storage batteries, and has an automatic battery-charging device mounted on top of the hood.

Nelson Stud Welding Div., Morton Gregory Corp., Lorain, Ohio **Booth 2559**

(MORE DATA? CIRCLE FYI 48, p. 197)



Sperry Hose Line Coupling Seals When Disconnected

The Sperry self-sealing coupling, made in various types and sizes, is a connector for gas or liquid pipe and hose lines. It serves as a coupling, with quick disconnect convenience, and automatically seals both line ends when disconnected.

Each half of the coupling contains a valve which is held shut by a spring, plus any line pressure. As the two halves are brought together, the valves are forced open.

The wing nut coupling, Type CW, requires no wrench and uncouples in approximately seven turns. Cam lock coupling, CJ, needs less than one turn to disconnect it by hand. —the coupling illustrated. The hex nut coupling, Type CA, allows the use of a wrench to connect it in high-pressure applications.

Sperry Products, Inc., Danbury, Conn. **Booth 228**

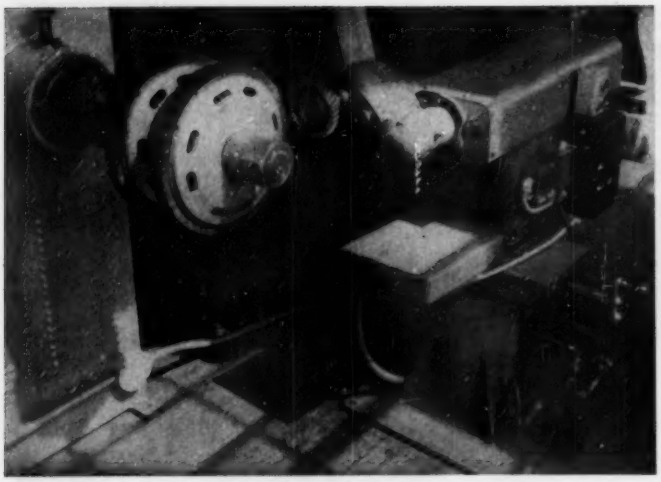
(MORE DATA? CIRCLE FYI 49, p. 197)

Detrex DeGreaser Has Rotary Internal Conveyor

Detrex has developed a degreaser with a rotary internal conveyor for the handling of work through a vapor-spray-vapor or a vapor-immersion-vapor cleaning cycle. The mechanism indexes to a loading station where baskets or trays of work are loaded into position from a gravity roller conveyor. It is identified by the trade name Gyro.

Detrex Corp., Detroit 32, Mich. **Booth 2222**

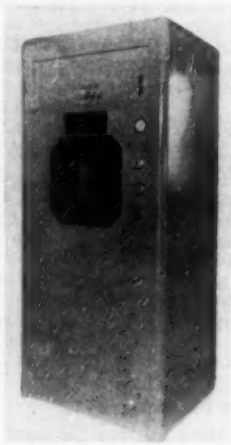
(MORE DATA? CIRCLE FYI 50, p. 197)



Osborn Brushing Method Deburrs Gears Faster

An Osborn development uses a semi-automatic universal workpiece holder and brushing lathe to deburr gears. Using the old hand method, an operator was able to produce only 20 finished gears per hour. The holder and lathe bring it up to 180.

The Osborn Manufacturing Co., Cleveland, Ohio **Booth 319**
(MORE DATA? CIRCLE FYI 51, p. 197)



Tocco Provides 3 Units For Induction Heating

A Tocco induction-heating system consists of three basic units, a heating station (illustrated) a rectifying and oscillating unit, and a motor-generator set.

Vertical design of the high-frequency motor-generator set takes less floor space. Features include heat-exchanger water cooling plus thermal protection against overheating of bearings, generator and motor. It is available in two sizes: 250 kw output at 10,000 cps; 300 km output at 3000 cps.

The ac from the motor-generator set is then directed to a Toccotron unit where it goes through an oscillating and rectifying circuit. The unit is designed to furnish high-frequency power at 450,000 cycles. Electronic cubicles containing the circuits are so designed to permit one- or two-station output.

The last units are the heating stations which can be located anywhere in the plant. They may be operated one at a time or a dozen at a time from one high-frequency source.

The Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland **Booth 910**
(MORE DATA? CIRCLE FYI 52, p. 197)

Prepared - atmosphere generator, known as the MRX-800, is the company's largest-capacity endothermic generator to be developed as a standard-rated catalog unit. It is designed to produce 800 cfh of atmosphere gas for use in gas carburizing, dry cyaniding, clean hardening, and bright annealing of all types of steel.

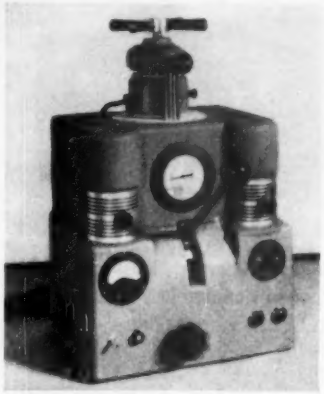
Surface Combustion Corp., Toledo, Ohio. **Booth 1106**
(MORE DATA? CIRCLE FYI 53, p. 197)

Austrian Metallurgical Microscope Permits Many Kinds of Illumination

This metallurgical microscope with built-in camera is said to be compact and easy to operate. A universal opaque illuminator with Epilum objectives permits many kinds of illumination: light and dark brown, oblique internal, and unilateral external illuminations, ordinary and polarized light.

Equipment is provided for testing for Vickers hardness of single crystals. It can be used with a miniature camera, and there are components for drawing or projection.

William J. Hacker & Co., Inc., 82 Beaver St., New York **Booth 2453**
(MORE DATA? CIRCLE FYI 54, p. 197)



Metallurgical Press Produces Bakelite Mounts in 3½ Minutes

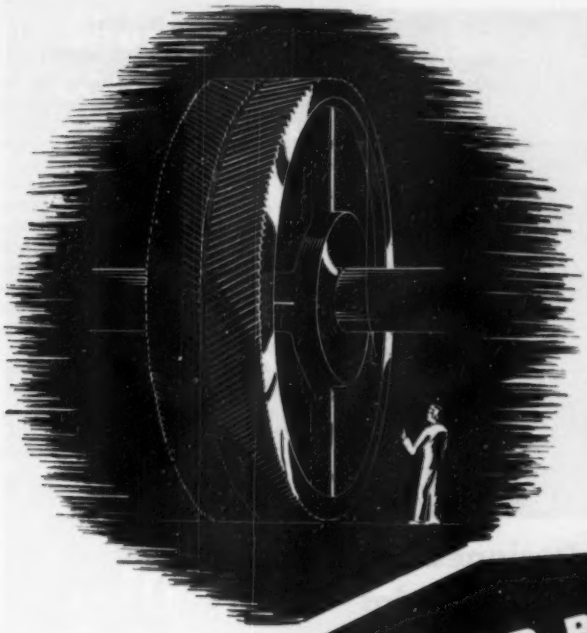
A premold assembly complete with heating compartment and ejector levers is one of the features of this AB metallurgical press. The assembly is said to offer increased convenience in handling and is available at little extra cost. It reduces the curing time one-third.

The operation is controlled by a pyrometer, timer, and thermostat. Hydraulic jack has a 10,000-lb capacity. Three models are available, ranging from $380 to $430.

Buehler Ltd., 165 W. Wacker Drive, Chicago 1, Ill. **Booth 615**
(MORE DATA? CIRCLE FYI 55, p. 197)

Fast-quenching oil in the Houghto-Quench Series has been developed. This oil enables a fast rate of speed through the quenching zone and assures adequate Rockwell-C hardness. It is being used on such parts as aircraft forgings.

E. F. Houghton Co., 303 W. Lehigh Ave., Philadelphia 33, Pa. **Booth 728**
(MORE DATA? CIRCLE FYI 56, p. 197)

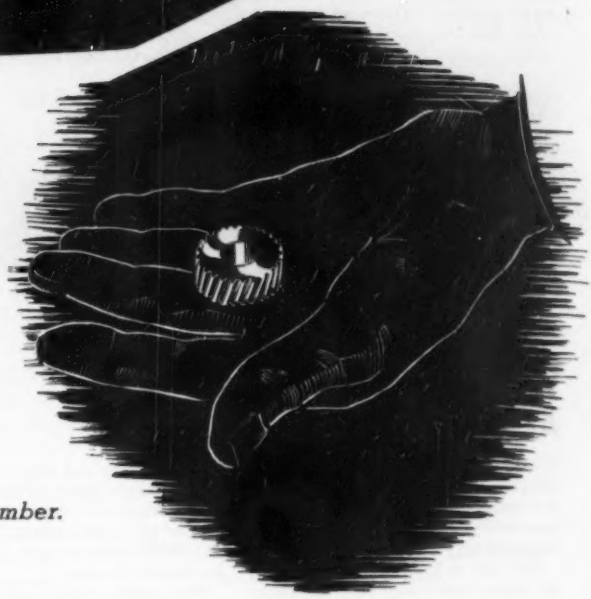


IS YOUR GEAR DEPARTMENT READY?

to meet competitive production rates?

to meet competitive costs?

AS BIG OR BIGGER
AS SMALL OR SMALLER



Michigan's "1950" production gear finishers are designed to produce all ranges of spur and helical gear sizes—external or internal; continuous runs or job lots—more accurately, at lower cost. Here they are:

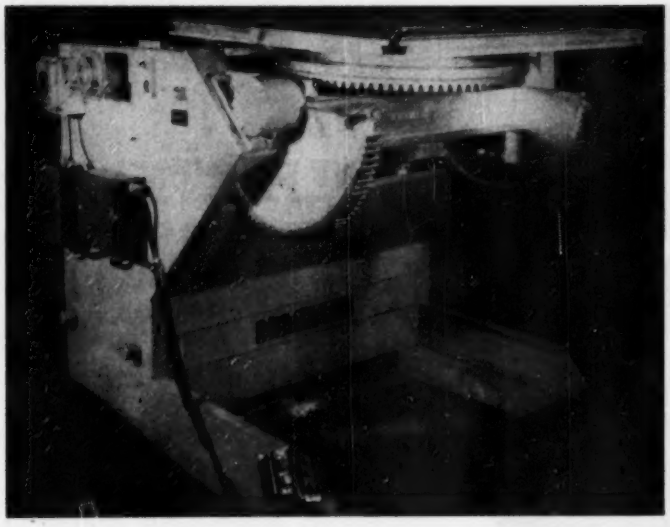
#861—for gears of ¼" to 4" OD
#900—for gears 1" to 8" OD
#870—for gears 1" to 18" OD
#873—for gears 2¼" to 24" OD
#865—for gears 4" to 48" OD

PLUS—finishers for gears up to many feet in diameter

Ask for bulletins by machine number.

COMPLETE — from blank to finished gear — EQUIPMENT

MICHIGAN TOOL COMPANY 7171 E. McNichols Road Detroit 12, U.S.A.



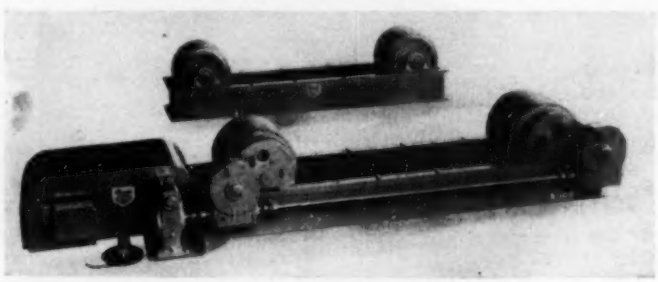
Gear-Driven Positioner Designed From Automatic-Welding Standpoint

These heavy-duty positioners are said to have been designed from the automatic-welding standpoint, so that they have all the necessary features. Some of these features include: machined, fabricated sector and bull gears for rotation and tilt; infinitely variable speed rotation on the work table; and a ground cable from the frame of the machine to the main journal of the worktable for safety.

The motors and variable-speed units are all enclosed within the covers over the top, front, back, and sides. The worktable height is adjustable 24 in. in 6-in. steps. Rotation and tilt through direct drives.

Aronson Machine Co., Arcade, N. Y. **Booth 2427**

(MORE DATA? CIRCLE FYI 57, p. 197)



Worthington Turning Rolls Are Easily Maintained

Worthington Model 75 turning rolls are said to be quicker and easier to maintain since the complete drive is removable for maintenance or replacement.

The unit is lower than the rollers for easier load handling from either side, or end. Other features include: anti-friction bearings, heavier drive (5-hp motor), sturdier construction throughout, rubber-tired rollers, chain coupling, and steplessly adjustable variable-speed drive. There is also a Model 75 idler roll which is similar in construction to the power roll. Both models have turning capacities of 75 tons.

Worthington Pump & Machinery Corp., Welding and Assembly Positioning Equipment Div., Harrison, N. J. **Booth 506**

(MORE DATA? CIRCLE FYI 58, p. 197)

Ozalid Copying Machine Has Constant Printing Speeds

Constancy in printing speeds is assured in this Ozalid dry-developing copying machine by a constant-wattage transformer to control voltage fluctuations.

A free-flowing developer circulatory system to produce even flow, molded V-drive belts to maintain constant speed ratio, vacuum-box sealing, instantaneous speed control, and other features have been put in the Streamliner. It accommodates material up to 42-in. wide, prints up to 10 ft per min, and develops up to 5 ft per min. It is wired for 60-cycles, single-phase, 205-250 volts ac.

Ozalid, Div. General Aniline & Film Corp., Ansco Rd., Johnson City, N. Y. **Booth 1827**

(MORE DATA? CIRCLE FYI 59, p. 197)

Improved Cluster Tools For Diamond Dressing

Two models of an improved cluster tool have been developed. Type T consists of a T-shaped diamond dresser containing many small, selected industrial diamonds intended to be used as dressing tool, or possibly as an offhand dresser. Type S consists of a number of small high-grade industrial diamonds set in a dome-shaped "soft bond" tungsten-carbide matrix.

National Diamond Laboratory, 108 Fulton St., New York 7. **Booth 2447**

(MORE DATA? CIRCLE FYI 60, p. 197)

Streeter-Amet Industrial Counters Have Wide Range of Uses

The model SC1 Streeter-Amet industrial counter can be actuated by any electrical pulse or signal from a contact switch, phototube and amplifier, or metal detector. It can also be adapted to register change in electrical intensity; thus permitting its use with an arc welder, punch press, or other electrically powered equipment which has a definite load change when operated. Or, it may be actuated by an external timing circuit to record the impulses received during a cycle.

Another model, the predetermining counter, operates when a set of external normally open contacts are closed. When the predetermined count is reached, a circuit is put into operation which may be used to operate various electrical circuits.

Streeter-Amet Co., 4101 N. Ravenswood Ave., Chicago 13, Ill. **Booth 2715**

(MORE DATA? CIRCLE FYI 61, p. 197)

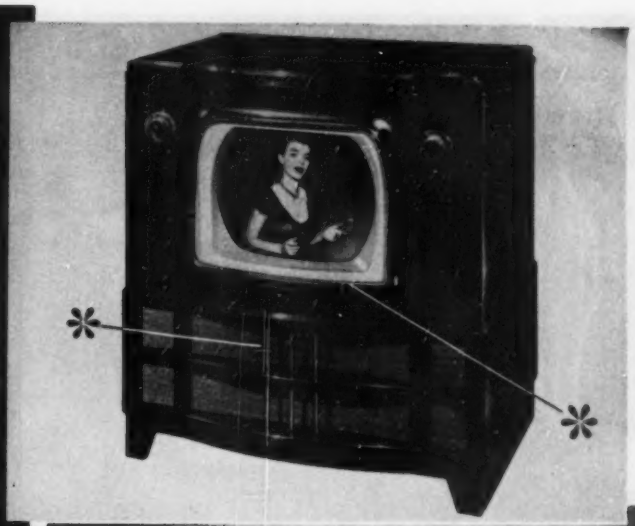
✻ REVERE COPPER AND BRASS *HELPS*

keep TV Sales Hot

FOR

~~CROSLEY~~

...makes Cabinets Cool and Classy



The newest Crosley Television Cabinets are striking examples of how copper and brass can be used to give products sales appeal as well as serve a utilitarian purpose.

All models, two of which are shown above, are equipped with gleaming bezels which frame the television screens. They are made for the Crosley Corporation from Revere 90-10 Commercial Bronze. The table model shown is equipped with two control escutcheons drawn from this same metal by the Rex Engineering Company, Cincinnati, Ohio. The table model also has two strips of .0016" Revere Soft Copper of 5½" width on the under side of the top of the cabinet. This acts as an insulator by conducting any heat generated, away from the wooden cabinets. For, although copper is the best heat conductor of the commercial metals, when highly polished it dissipates rather than absorbs heat.

Note on the console model, shown above, how the three Revere Brass Tubes add a touch of luxury and richness to the cabinet.

Perhaps Revere Copper or Brass or one of its other metals or alloys can help in the development and improvement of your product. Why not call the nearest Revere Sales Office and see?

REVERE

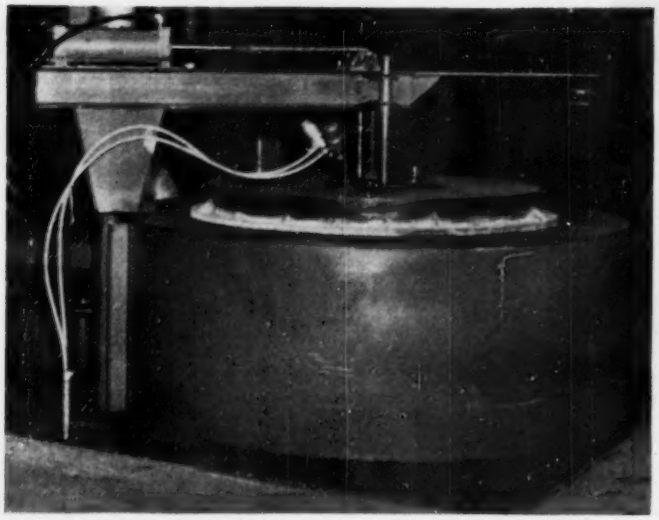
COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, New York

Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.

Sales Offices in Principal Cities, Distributors Everywhere



Uniform Heating Cuts "Soak" Time In Heat-Treating Furnaces

This heat-treating furnace employs two-pass convection heating in conjunction with controlling the volume and pressure of the heat-carrying gases. The gases are forced upward, releasing heat to the load by radiation and conduction. As the gases reach the top of the workbasket they are diverted downward through the load, heating by direct contact.

The secret of achieving a uniform control temperature quickly, lies in the variable speed fan which is thermocouple controlled. As the temperature increases, the radiant heat becomes more efficient. To compensate, the flow of gases passing the radiant heating zone is accelerated, reducing the amount of heat transmitted. This acceleration also increases the volume and pressure of the gases passing through the load, so that more heat is applied by convection, maintaining the equal temperature of the two zones.

Standard American Engineering Co., W. 43rd St., Lyons, Ill. **Booth 2743**
(MORE DATA? CIRCLE FYI 62, p. 197)

National Brass Forgings Have Parallel Walls; Deep Cores

Using a process developed in England, National is producing brass forging with these features: parallel walls—no draft required, long cores, coring on four sides in the same plane, and close limits in three dimensions. In many cases, only a minor drilling operation and tapping of both ends are required for a finished product. Tolerances are held to values of plus and minus 0.005 in.

The forgings are produced on 100- to 200-ton mechanical presses employing dies which are said to be comparable in cost to those used for solid forgings.

National Cored Forgings Co., Inc., Connecticut Ave., South Norwalk, Conn. **Booth 2123**
(MORE DATA? CIRCLE FYI 63, p. 197)

Optimus Degreaser Uses Vapor and Liquid Spray

The strong, flushing action of clean solvent is combined with a vapor phase in this degreaser. Chips, insoluble impurities, buffing compounds, are removed by flushing with a hand-spray line.

Parts are immersed in heavily concentrated vapors until condensation ceases. Pure condensate dissolves the oils and greases which drop to the sump below. A flexible hose and spray are then used for additional cleaning of any soil left.

Optimus Equipment Company, Matawan, N. J. **Booth 1732**
(MORE DATA? CIRCLE FYI 64, p. 197)

Beverly Slitting Shears Available in Three Capacities

Beverly SS-Series slitting shears, made in three sizes to handle 14-gage, 10-gage, and 3/16-in. mild steel, incorporate design features to provide maximum cutting capacity with minimum size and weight. Compounded linkage increases the mechanical advantage.

Beverly Shear Mfg. Co., 3004 W. 111th St., Chicago 43, Ill. **Booth 2623**
(MORE DATA? CIRCLE FYI 65, p. 197)

Alnico V-Magnet Used In Wheelco Pyrometer

This indicating pyrometer, Model 192, is said to be designed for those applications where size of heating equipment or space limitations demand the use of a small, sturdy, and economical instrument.

Some features are: High resistance "edgewise" movement with Alnico V-magnet. Mirrored scale is fully compensated.

Wheelco Instruments Co., 847 W. Harrison St., Chicago 7. **Booth 1909**
(MORE DATA? CIRCLE FYI 66, p. 197)

FYI

FOR YOUR INFORMATION

FREE details about new machines & tools
FREE data on new materials or parts
FREE shop calculators and data sheets
FREE information from advertisers
FREE advice on metalworking problems

FYI—these initials symbolize information that's important. We use them, too, to head our expanded reader service. Here are two postcards which will bring you new literature, bulletins on new equipment, materials or parts, further information from any advertiser, or advice from editors—for a 3-cent stamp.

ALL YOU DO is circle on the lower card the number of any shop equipment item about which you want more data or any piece of manufacturer's literature of which you want a copy.

For details on an advertised product, write the page number in one of the boxes provided, adding the advertiser's initials if more than one advertisement appears on the page—if the page is unnumbered, as a cover or insert, or the ad shows several products, use initials and write in the product name. Fill in your name, title and address, cut out the card, add a 3-cent stamp and mail. We do the rest, saving you time, trouble, and money. Use this card for requesting manufacturers' literature or more details on new equipment. →

NEW BULLETINS

MACHINES AND ATTACHMENTS

1 SURFACE GRINDING—*The Blanchard Machine Co., Cambridge 39, Mass.* 83-page booklet—the latest edition of "Work Done on the Blanchard." Contains information on the surface grinding of metal, glass, and ceramic parts. Illustrations show correct grinding techniques, chucking methods, etc.

2 DRAWING PRESS—*The Hydraulic Press Mfg. Co., Mount Gilead, Ohio.* Bulletin 4903 describes the Twin-Power Press, a development which gives up to 70% more strokes per minute with no increase in draw speed. First half of the power stroke is accomplished hydraulically.

3 POWER PRESSES—*Sales Service Machine Tool Co., St. Paul, Minn.* 8-page catalog contains technical data and general information on a line of open-back inclinable power presses with large die spaces.

4 COOLANT SYSTEM—*The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.* 2-page circular M-1716 describes an improved Mist-Type coolant system for the company's No. 2 cutter and tool grinders.

TOOLS AND ACCESSORIES

5 TEMPERATURE CONTROLS—*The Partlow Corp., New Hartford, N. Y.* 24-page manual sets down the basic principles of temperature control, describes 9 instruments, and gives principles of mercury-bulb installation.

6 PULLERS—*Owatonna Tool Co., Owatonna, Minn.* 20-page bulletin illustrates and describes a line of pullers with various adapters and attachments.

7 DIAL SNAP GAGES—*Standard Gage Co., Poughkeepsie, N. Y.* 4-page folder shows how you can convert an AGD adjustable-limit snap gage (models A, B, or C) into an indicating-dial snap gage.

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27 28 29 30 31 32 33 34 35 36 37 38 39
40 41 42 43 44 45 46 47 48 49 50 51 52
53 54 55 56 57 58 59 60 61 62 63 64 65
66 67 68 69 70 71 72 73 74 75 76 77 78
79 80 81 82 83 84 85 86 87 88 89 90 91
92 93 94 95 96 97 98 99 100 101 102 103

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FYI

FOR YOUR INFORMATION

FREE details about new machines & tools
FREE data on new materials or parts
FREE shop calculators and data sheets
FREE information from advertisers
FREE advice on metalworking problems

8 WELDING FIXTURES—*Progressive Welder Sales Co., Detroit 34, Mich.* 4-page catalog gives details on a line of locating and holding fixtures for processes such as welding, soldering, punching and notching.

9 PORTABLE GRINDERS — *Onsrud Machine Works Inc., Chicago 47, Ill.* 4-page bulletin 1129 illustrates and describes a line of air-turbine portable grinders and motors.

PLANT SERVICE EQUIPMENT

10 ELECTRIC DISTRIBUTION — *Feedrail Corp., New York 7, N. Y.* 60-page catalog completely describes an all-purpose trolley busway system of electrical distribution. It shows how to plan an installation, and gives specifications on component parts such as track sections and trolleys.

11 TRANSFORMERS—*The Superior Electric Co., Bristol, Conn.* 16-page bulletin describes in detail manually operated and motor-driven variable transformers, and line correctors. Rating chart provides a quick selector index.

12 LIFT TRUCKS—*Lift Trucks Inc., Cincinnati 14, Ohio.* 4-page folder describes and illustrates a line of lift trucks which feature a hydraulic ram for easy lifting. Specifications are included.

13 DRUM RECONDITIONING — *American Wheelabrator & Equipment Corp., Mishawaka, Ind.* 4-page folder gives information on the equipment and methods needed for the cleaning of the exterior and interior of drums.

14 STORAGE RACKS — *Barrett-Cravens Co., Chicago 9, Ill.* 16-page catalog contains specifications and details on a line of drum, skid, and carboy racks. Illustrations show typical shop installations.

PARTS AND MATERIALS

15 WORM-GEAR DRIVES—*Link-Belt Co., Chicago 1, Ill.* 80-page catalog illustrates, describes, and tabulates worm-gear drives of three basic types. Each is available in 10 different sizes, for fractional or large horsepower, and in speed ratios up to 8000 to 1.

16 NICKEL REPORT—*The International Nickel Co., Inc., New York 5, N. Y.* 24-page bulletin reports on the resistance of nickel and its alloys to corrosion by caustic alkalies. Methods of testing as well as results are given.

17 ALLOY CASTINGS — *Michiana Products Corp., Michigan City, Ind.* 16-page booklet describes heat-resistant, corrosion-resistant, and abrasion-resistant castings produced by the company. Tables and charts show properties.

18 TUBING—*J. Bishop & Co. Platinum Works, Malvern, Pa.* 12-page bulletin gives sizes, specifications and applications of stainless, nickel, and nickel-alloy tubing.

19 LAPPING COMPOUND — *Timesaver Products Co., Chicago 6, Ill.* 24-page brochure shows how to use the compound, describes its properties, and lists the various grades.

20 SELF-LOCKING NUTS — *Boots Aircraft Nut Corp., Stamford, Conn.* 24-page catalog gives data such as sizes, dimensions, materials, and types of anchor bases on a line of self-locking nuts.

21 EYE SAFETY—*Bausch & Lomb Optical Co., Rochester 2, N. Y.* Slide card gives proper safety-glass styles corresponding to each of 69 job classifications.

22 PRESSURE VESSELS — *A. O. Smith Corp., Milwaukee, Wis.* 16-page booklet deals with Multi-Layer construction, showing design features, materials used, analysis of stress factors, and various applications.

23 PRESSURE BOOSTERS — *Miller Motor Co., Chicago 18, Ill.* 12-page bulletin B-200 tells how fluid-pressure boosters can save space and weight, cut costs, and increase efficiency in clamping, punching, and similar applications.

24 AIR COMPRESSORS — *Ingersoll-Rand Co., Phillipsburg, N. J.* 8-page bulletin shows various sizes and models of the T Series stationary line. Gives cross-sectional views, engineering data, sizes, and dimensions.

25 UNLOADERS—*Sahlin Engineering Co., Birmingham, Mich.* 6-page booklet describes the Iron Hand, a self-contained automatic unloader used to remove sheet-metal stampings from presses.

26 RUST PREVENTION — *Nox-rust Chemical Corp., Chicago 8.* 4-page bulletin covers Nox-rust 310-AC which removes finger prints and deposits a thin transparent film.

MISCELLANEOUS

27 CELLULOSE ESTERS—*Tennessee Eastman Corp., Kingsport, Tenn.* 59-page booklet covers uses and specifications, compatibility with solvents, and procedures of analysis.

28 SALES—*Remington-Rand Inc., New York 10, N. Y.* 26-page booklet details how machines and systems can be used to compile sales-analysis facts and utilize them for checking sales.

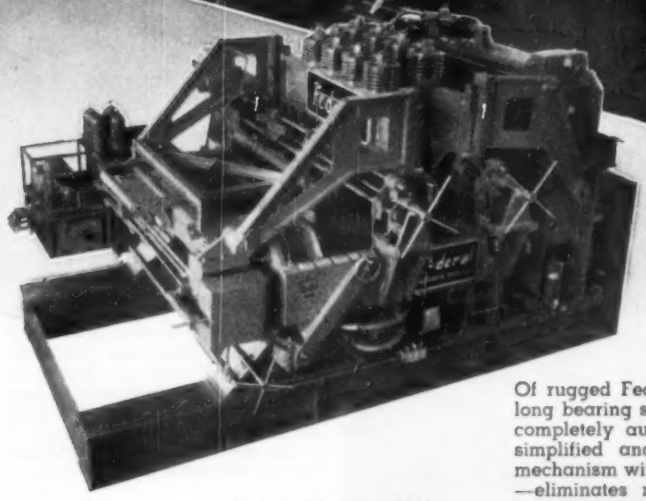
29 STRIPPERS—*Enthone Inc., New Haven 2, Conn.* 4-page bulletin covers fast-evaporating, water miscible, and brush-on strippers for organic finishes.

30 HUMIDITY CHAMBERS — *Bowser Inc., Terryville, Conn.* 4-page bulletin describes relative-humidity test chambers. Includes information on performance, construction, and specifications.

Results!

that's what keeps FEDERAL First in Resistance Welding

Welder assembly line at Federal. Results keep it humming.



66" Combination Flash Welder and Flash Stripper.

The welder pictured here is a 66" combination flash welder and flash stripper, designed and built by Federal for use in a continuous steel processing line.

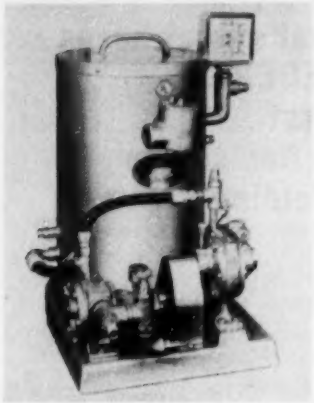
Of rugged Federal side bar construction with long bearing supports, the machine is the first completely automatic welder of its kind. A simplified and extremely flexible hydraulic mechanism with a single central control station —eliminates need for special operator and minimizes time and effort required to change set-up from one strip size to another.

This is another example of how Federal resistance welding "know-how" gets results. The kind of results that keeps Federal first in resistance welding.

Federal WELDERS

THE FEDERAL MACHINE & WELDER COMPANY
Warren, Ohio

Warco PRESSES



Bede Paint Heaters For Hot-Spray Process

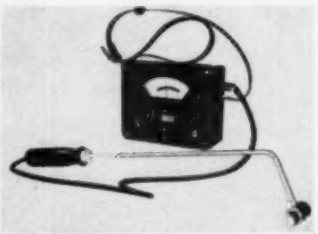
A process for spraying paint, varnish, and lacquer at steaming-hot temperatures is said to have the advantages of better-looking, higher-quality painted surfaces, and substantial cost reductions. Heat replaces a large part of the solvents presently used in paints—a higher percentage of solid material and pigment is sprayed so that flaws on the surface are covered better and drying is speeded up.

The device heats the paint as it flows to the spray gun. Two models are available, a standard model and a circulating model, which is shown in the photograph. The circulating model, in addition to heating the paint, also maintains a constant circulation between the heater and the spray gun, thereby maintaining a constant temperature at the gun. It can also draw paint directly from any paint container without the use of a pressure tank.

Aluminum is used as the heat transfer medium between the cartridge heaters and the paint coil. The heater is said to come to operating temperature within 15 minutes. Available for 110 and 220 volts.

Bede Products Inc., 4311 Ridge Road, Cleveland 9, Ohio **Booth 2402**

(MORE DATA? CIRCLE FYI 76, p. 197)



Wheelco Portable Indicator Measures Tin Content in Solder

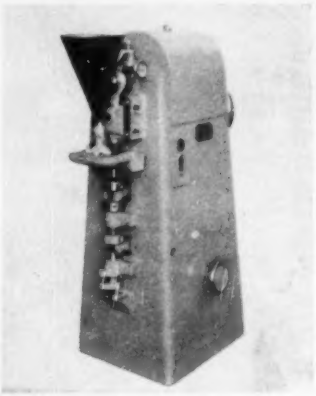
The Wheelco tin-content indicator for solder is a checking instrument for quick analysis of solder quality. It provides a means of determining the ratio of the lead and tin content for process standards.

The method of obtaining the percentage of tin content is based on the difference in temperature between a lead standard and a lead tin alloy sample, while these materials are passing from liquid to solid consistency. The lead sample is permanently sealed in one of the cups of the sensing unit, while the solder sample to be tested is scooped into the other cup and retained there until reading is obtained.

It is portable, direct reading, and consists of a high resistance pyrometer and a sensing unit. The meter movement is supported by two lapped pivots resting in sapphire jewels.

Wheelco Instruments Co., Chicago 7, Ill. **Booth 1909**

(MORE DATA? CIRCLE FYI 78, p. 197)

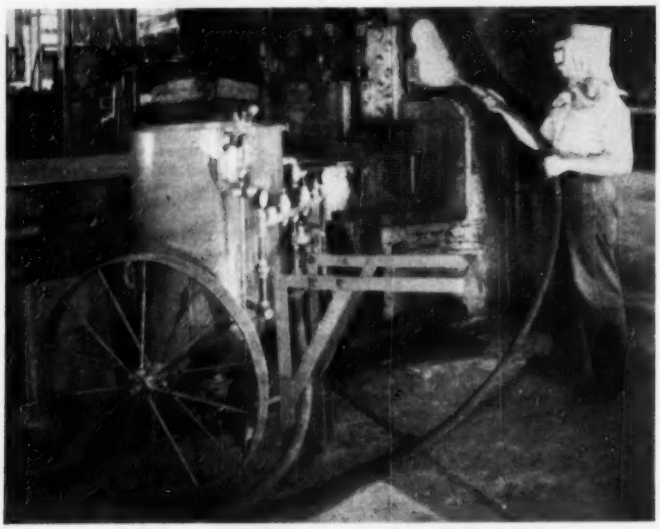


Stokes Powder-Metal Press Produces at Rates up to 60 a Min.

This powder-metal press produces a machine part from brass powder at rates up to 60 a minute. Known as Model F-4, it has a capacity of four tons and applies pressure from both above and below simultaneously.

F. J. Stokes Machine Co., Philadelphia 20, Pa. **Booth 420**

(MORE DATA? CIRCLE FYI 79, p. 197)



PORTABLE BLAST MACHINE using finely-ground corn cobs as an abrasive has been developed by Pangborn. It is used for air-blast cleaning, degreasing, and reconditioning of armatures, motors, machinery and plant equipment.—*Pangborn Corp., Hagerstown, Md.* (MORE DATA? CIRCLE FYI 77, p. 197)

Safety shoes are available in an 8-in. model which affords protection above the ankle and also an ankle-high shoe which has been designed with heavy oak-leather single soles. Both models are of the lace-to-toe style, are of black elk, and are leather lined under the steel box toe.—*Safety First Shoe Co., Holliston, Mass.* **Booth 2520**

(MORE DATA? CIRCLE FYI 80, p. 197)

RADIOGRAPHY pointed the way to sound production

Radiography revealed a recurring irregularity in a simple production casting—showing the need for a change in casting procedure.

Simple castings are not always soundly made the first try. These were for a customer who had learned to expect highest quality from the foundry.

The first group cast was checked radiographically. Similar irregularities were found in nearly every part, indicating the need for a change in casting procedure. With the help of radiography the change was made with a minimum of lost time, and sound parts were quickly cast and delivered to the customer.

Any foundry that seeks a reputation for producing consistently sound castings will find radiography an invaluable aid. It detects irregularities. It pictures the effects of changes in gating, venting, pouring temperatures, chilling, and other variables. It pays for itself from savings in development time and in reduced rejections—builds customer good will.

Ask your x-ray dealer to explain all the ways radiography can help you increase yield and cut costs, or ask Kodak for a copy of "Radiography as a Foundry Tool."

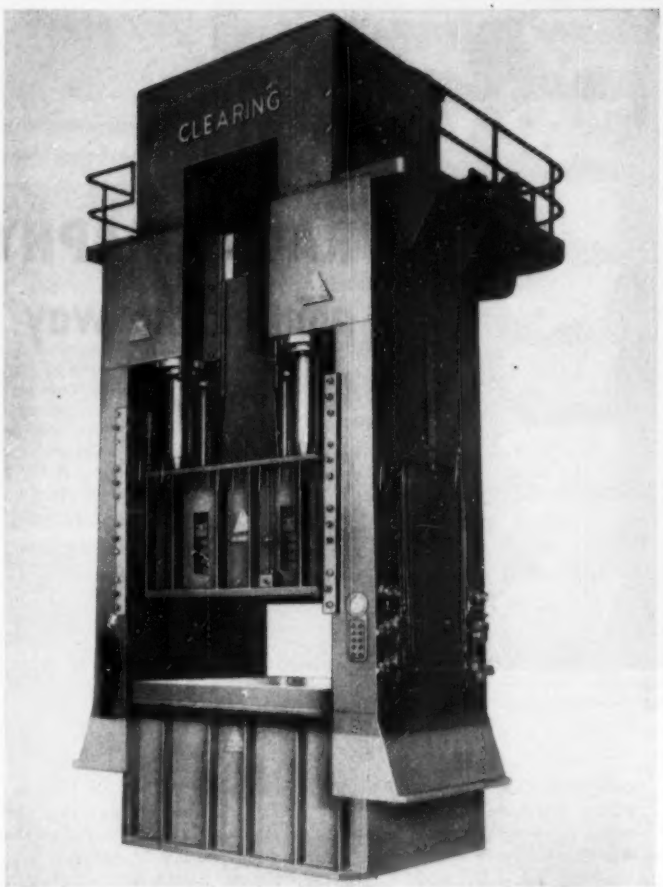
EASTMAN KODAK COMPANY
X-ray Division
Rochester 4, N. Y.

Radiography . . .

another important function of photography

Kodak
TRADE-MARK

New Shop Equipment Materials and Parts



Clearing Hydraulic Presses Stop Blankholder Pressure Losses

A line of heavy double-action presses made by Clearing have two independent hydraulic circuits, one for the blankholder slide, and the other for the punch slide, each with its separate pump. This arrangement is said to preclude the possibility of losses in blankholder pressure during the punch stroke. The pressure on each corner may be individually adjusted, so that eccentric or irregular draws are easily handled.

Another feature is a provision for slowing the punch slide at the instant the blankholder slide is picked up on the return stroke. This action eliminates the shock encountered when the punch slide picks up the motionless blankholder. A positive drive for both slides allows the gibbing to be set closely, helping to assure accurate work.

The extended gibbing of the punch slide in the crown is advantageous when eccentric loading conditions are anticipated. They are adjustable within the blankholder slide while the blankholder itself is guided by deep gibs which may be regulated to compensate for wear.

The presses are available in any required size — the one illustrated having a 72 by 108-in. bed and arranged for an 18-in. draw and liftout.

Clearing Machine Corp., Chicago, Ill.

(MORE DATA? CIRCLE FYI 81, p. 197)

Magnetic Chuck Has Unusual Holding Power

Electric magnetic chuck, designed for use on lathes, features great holding power. Work is held to the surface of the chuck by magnetic forces with a total pull of over 2 tons.

The unit includes a control box that plugs in on 115 volts, 60 cycles. The chuck itself plugs into the control box, which has two switches, one for energizing the surface of the chuck, the other for demagnetizing the chuck surface, effecting the holding or release of the work part.

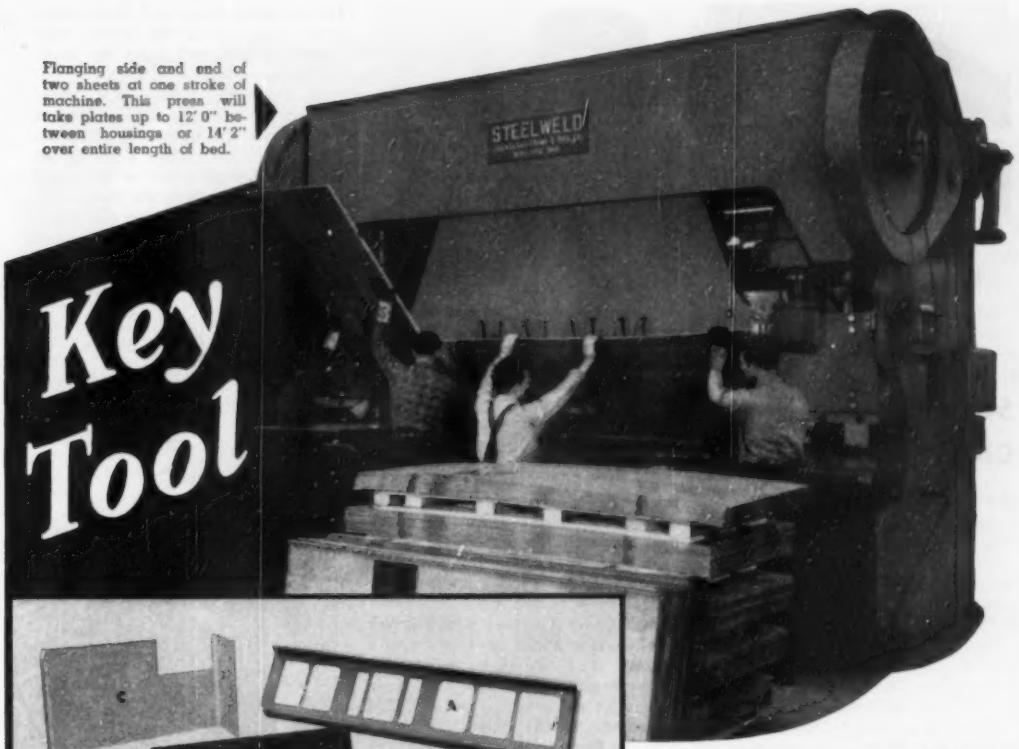
The chuck can be used for many set-ups requiring heavy cuts on lathe work which were previously impractical on magnetic surfaces. It can be employed as a magnetic inspection tool for cracks and fractures not ordinarily visible.

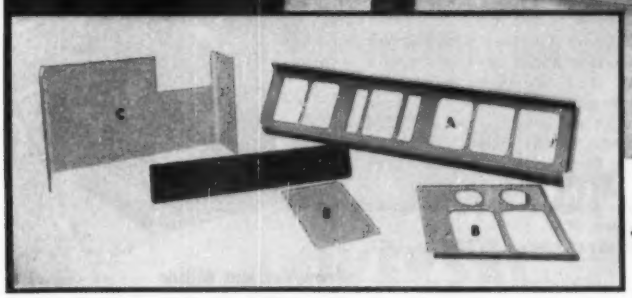
Continental Electric Co., Hawthorn, Calif.

(MORE DATA? CIRCLE FYI 82, p. 197)

Flanging side and end of two sheets at one stroke of machine. This press will take plates up to 12' 0" between housings or 14' 2" over entire length of bed.

Key Tool





A few of the many parts produced to close tolerances including braking, flanging, punching large openings and drawing: (A) capping of 18 ga. stainless, (B) capping of .031 stainless, (C) panel of 18 ga. Armco Paint Grip, (D) reinforcing of 14 ga. hot rolled, (E) evaporator bottom of 18 ga. Armco Zinc Grip.

IN MANUFACTURING SODA FOUNTAIN EQUIPMENT

A STEELWELD Model K5-12 Press is a key tool at Liquid Carbonic Canadian Corp., Ltd., Montreal, and has an important role in the production of ice cream cabinets, soda fountain equipment, tanks and containers.

The press is used for various parts made of metals such as mild steel, copper, monel, stainless steel and a number of alloys. The work includes bending, forming, beading (such as tops of stainless steel kettles with reinforcing rod inserted), punching large holes and drawing operations.

Parts are usually run through in small lots of 50 to 500. This necessitates frequent die changes, but because of the ease of doing this work on a Steelweld Press, little production time is lost. The machine is in operation 50 hours per week.

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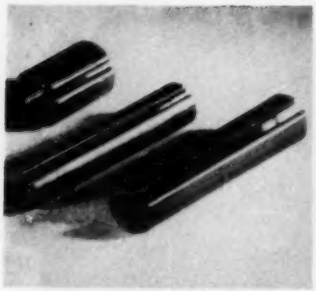
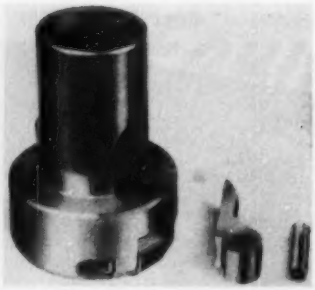


Shown are three of the thirteen sizes of the Rollpin. Slot along the axis permits compression of the pin.



The Rollpin holds in place the actuating finger for the feed-tube clutch assembly on automatic screw machines.

Self-Locking, Rapid Assembly Claimed for Slotted Pin

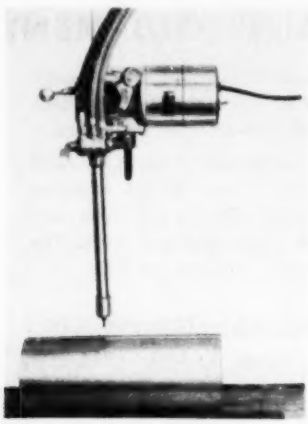
A metal fastener, called the Rollpin, has been designed to replace a variety of dowel, pivot, tapered and grooved pins, which ordinarily require a key or some supplementary fastening method to hold them in place.

The pin is a piece of metal rolled into the shape of a cylinder with a gap or slot which parallels the long axis of the hollow cylinder. Both ends are chamfered to facilitate press fitting. The slot permits compression of the cylinder as the pin is driven in, and the resulting tension secures it in position.

The slotted design affords a high-pressure, shake-proof grip in holes drilled to normal tolerances, and, as a result, expensive hole-reaming operations are avoided. The pin is inserted with hand tools or automatic jig assemblies. Applications fall into five groups: as fastening pins, pivot or hinge pins, cotter keys, shafts, and dowels. It is said to be sufficiently elastic to absorb the effects of vibration without fatigue, and without loosening. Thirteen sizes are available to fit hole diameters ranging from 0.078 to 0.50 in.

Elastic Stop Nut Corp., 2330 Vauxhall Rd., Union, N. J.

(MORE DATA? CIRCLE FYI 84, p. 197)



Brazing and Soldering Gun Used with Conveyor System

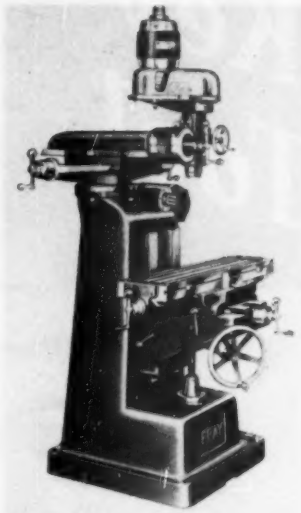
Brazing or soldering is being done with a gun which is used to feed the wire at some fixed speed which synchronizes with the speed of the workpiece along a conveyor belt. The unit, powered with constant-speed induction motor, can be started or stopped instantly, will feed the wire continuously or intermittently as desired, and once put in operation will operate automatically.

When set-up for brazing, the gun is usually mounted over the workpiece so the work will pass along under it. The tube that guides the wire is set in a vertical position with the end of the brazing tip set about 1¼ in. away from the surface. Small metering holes are used between the gas regulators and brazing tips to slow down the gas velocity. A fluxing gas is introduced into the natural gas lines, and phos-copper wire is employed. The speed used will depend upon the amount of copper required to fill the seam, the diameter of the wire used, and the gage and material being worked on. In practice, it has been found that seams can be brazed at the rate of 60 to 120 ipm. The wire is set into the flame just fast enough so it falls in small drops and, these drops being enclosed in the flame, they remain molten and enter the seam in that condition.

In soldering installations, fore-burners and afterburners are used to heat the work sufficiently so that the solder will flow. The tube which guides the wire is set at an angle of 45° to the work so the flame does not strike directly on the surface.

Metallizing Co. of America, 3520 W. Carroll Ave., Chicago 24, Ill.

(MORE DATA? CIRCLE FYI 85, p. 197)



Fray Vertical Miller Forms Wide Variety of Work

Combining the features of several machines, the Fray No. 10-R is an all-purpose milling machine suited for a wide variety of operations on a single piece of work. Machining operations can be done at any angle in either or both the vertical and horizontal planes.

Milling, drilling, and boring can be done at any angle, by traversing the ram on the turret slide, or crosswise by operating the ram in its saddle. The turret assembly permits extended ram adjustments, and rotation over 360°. Still further flexibility is obtained with the All-Angle milling attachment, which rotates 360° around the over-arm, and 90° forward or back. Thus any angle up to compound two-way is obtained without changing the work setup. The table has three machined T-slots, with channels and sump at each end for draining off coolant.

Fray Machine Tool Co., 515 W. Windsor Rd., Glendale, Calif.

(MORE DATA? CIRCLE FYI 86, p. 197)

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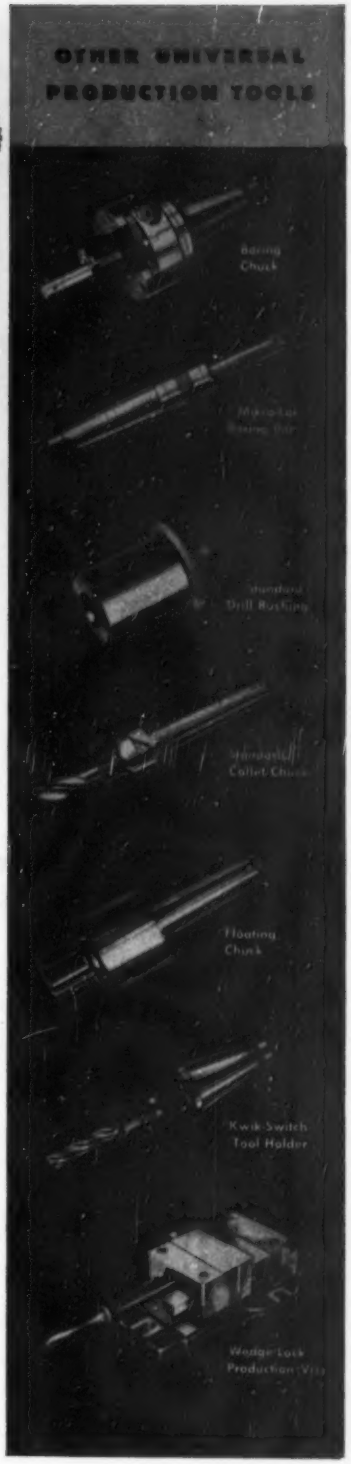
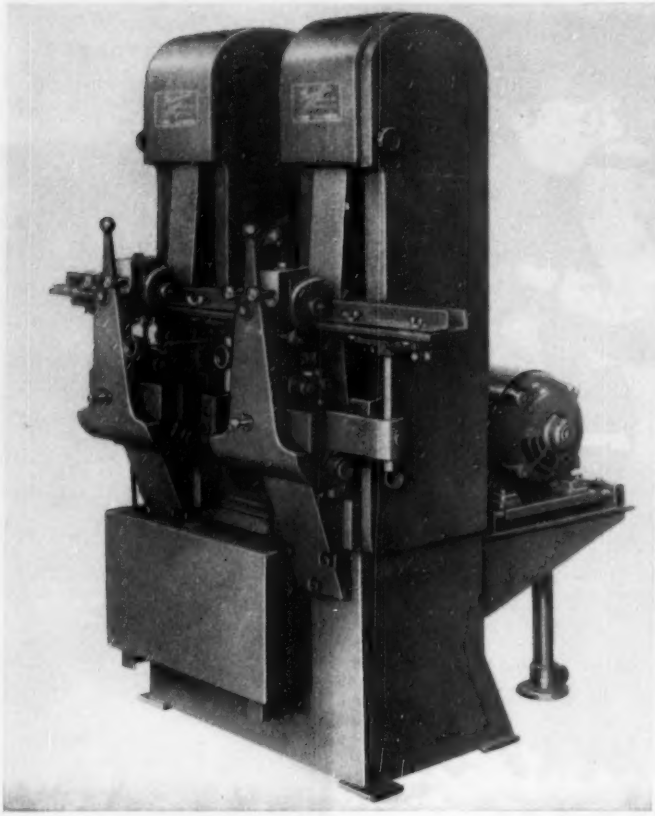




Duplex Polishing Machine Handles Many Kinds of Material

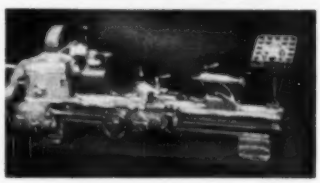
Capacity	1/16 to 1 1/2 in. dia.
Belt Length	4x84 in.
Belt speed	5000sfm
Drive	Uni-Pull belt
Motor	3 hp, 1800 rpm

Shown for the first time at the A.S.T.E. show held at Philadelphia in April, this centerless polishing and finishing machine is designed to operate under continuous production loads. It will handle cylindrical work up to 1½-in. diameter of limited weight, either straight or tapered, and produce a variety of finishes on many materials. Work may be fed either manually, or by means of hoppers or other automatic feeding devices suitable for the individual application.

The main guard is equipped with a hinged door to facilitate rapid belt changes, and 4-in.-diameter openings connect to the exhaust system. Standard fibre workrests, single and double ball bearing roller platens are furnished for each polishing member.

Production Machine Co., Greenfield, Mass.

(MORE DATA? CIRCLE FYI 87, p. 197)



South Bend Toolroom Lathe Takes Work to 10-in. Diameter

Max. collet capacity	5/8 in.
Centers	No. 2 Morse taper
Swing over saddle cross-slide	6 1/4 in.
Tailstock spindle travel	2 1/8 in.
Cross-slide travel	5 7/8 in.
Spindle speeds	48 to 1435 rpm

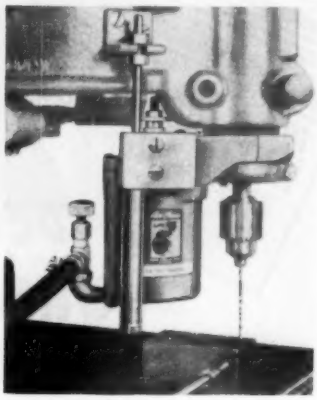
Known as the Light Ten, these lathes take work up to 10-in. diameter over the bed. Large handwheels, micrometer-graduated feed collars, and convenient controls are claimed to reduce operator fatigue and help prevent mistakes.

It is delivered equipped with a precision leadscrew having a lead variation of 0.0015 in., or less; lead variation in any one foot; a handwheel draw-in collet attachment; collet rack; taper attachment; thread dial indicator; thread-cutting stop; large face plate; and micrometer carriage stop. Tailstock spindle has 1/10 in. graduations and the tailstock screw has a micrometer collar reading in thousandths.

Bed lengths of 3, 3½, and 4 ft are available with maximum distance between centers of 16⅛, 22⅛, and 28⅛ in. respectively.

South Bend Lathe Works, South Bend 22, Ind.

(MORE DATA? CIRCLE FYI 88, p. 197)



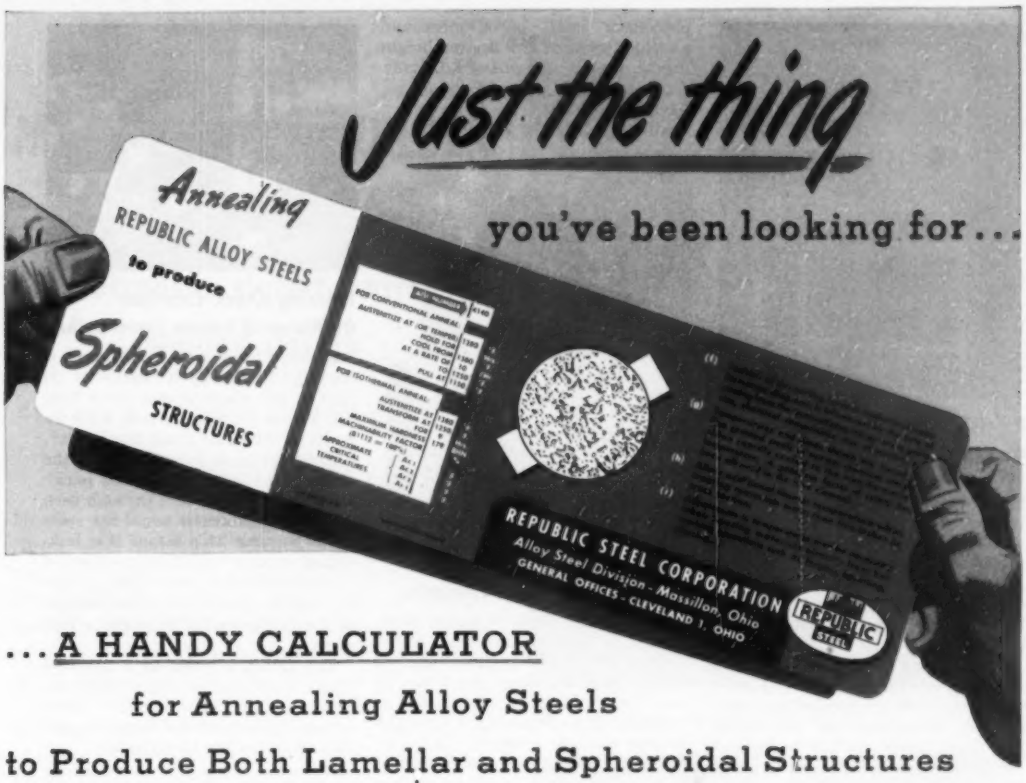
Mead Hydro-Check For Pneumatic Drillpress Feed

A short, stiff spring has been furnished in pneumatic drillpress feeds to slow the advance of the drill just before reaching the break-through point. This is said to be, at best, an expedient which does not solve all the problems encountered in the power feeding of a drill.

The Mead Hydro-Check is said to be the answer, since it offers a steady resistance to the power of the air feed, or increased resistance at a definite point in the stroke. It is attached to the feed through two holes in the mounting block; a small bracket being used to connect it to the drillpress head. Two collars in the ram can be set at any desired point.

Mead Specialties Co., 4114 N. Knox Ave., Chicago 41, Ill.

(MORE DATA? CIRCLE FYI 89, p. 197)



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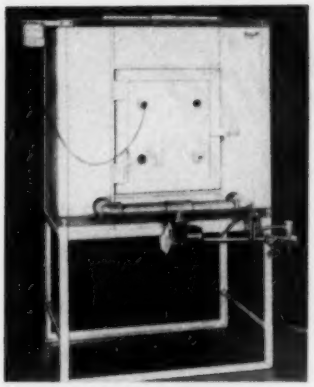


Precision Furnace Economizes On Metal Heat-Treating

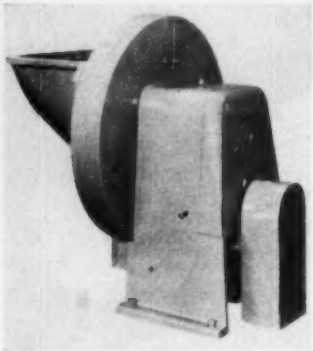
Precision furnace for the heat-treating of metals is available in capacities ranging from 1.8 to 20 cu ft and has a range of from 0 to 2500 degrees. Porcelain-protected thermocouples are included, as well as direct-reading pyrometers with calibrated energy input and atmosphere proportioning.

Economy of operation is possible through use of a forced-draft burner which will operate successfully with natural, manufactured, or liquid petroleum gases. Safety is insured by means of a solenoid valve which cuts off the fuel in the event that an electrical failure stops the blower, then automatically relights and resets the fuel input when the failure has been corrected.

Insulation is such that the outside temperature of the furnace is about 150 F at the height of operation. In processing small parts, moreover, multiple decks of any desired height can be used, thus assuring full loads.

A. D. Alpine, Inc., 11837 Teale St., Culver City, Calif.

(MORE DATA? CIRCLE FYI 92, p. 197)



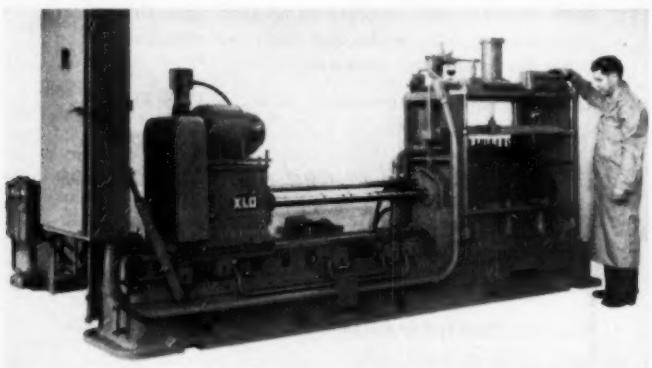
Four Standard Sizes Added to Line of Rotary Hoppers

Four standard sizes of rotary cast-aluminum hoppers have been added to the company's original line of tumble hoppers. Sizes are 8 in., 12 in., 16 in., and 24 in. in diameter.

A built-in gear reducer is arranged to give variable speed to the rotor. According to the manufacturer, this type of hopper is adapted to the feeding and orienting of most cylindrical workpieces. The manufacturer will quote only upon submission of samples.

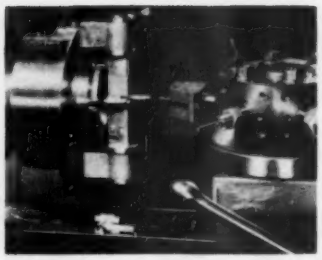
Kraus Design, Inc., 950 Exchange St., Rochester 8, N. Y.

(MORE DATA? CIRCLE FYI 93, p. 197)



LINE-BORING MACHINE finishes crankshaft and camshaft bearings in engine blocks simultaneously. The operator pushes the blocks into the fixture, touches the cycle button, then removes the blocks at the completion of the cycle. The tools are held in solid boring bars, rigidly supported for accurate bearing alignment. Production is from 25 to 35 blocks per hour. *Ex-Cello-O Corp., 1200 Oakland Blvd., Detroit 32, Mich.*

(MORE DATA? CIRCLE FYI 94, p. 197)



Indexing Chuck Cuts Time On Warner & Swasey Turret Lathe

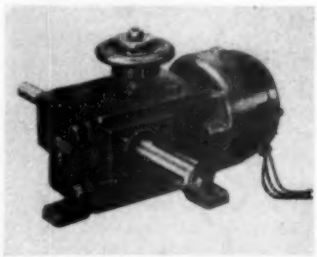
Indexing chuck built for Warner & Swasey Electro-Cycle machines is said to cut machine and work-handling time on appropriate work as much as 50%.

Actuated by a floor air valve, the chuck jaws index on an axis parallel with the chuck face through each of four 90° positions while the spindle is turning. This means that individual cutting operations performed at successive faces of a hexagon turret may be completed at one setting of the turret on, for example, a pipe cross.

The design is based on a standard chuck body and closing mechanism, using master jaws which index through power drawn from the machine's stationary air cylinder.

Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio

(MORE DATA? CIRCLE FYI 95, p. 197)



Janette Gearmotor For Combustion-Control Systems

Developed for combustion-control systems, the Janette BO gearmotor uses double-reduction worm gearing to furnish an output speed of 0.4006 rpm, and 220 lb-in. of output torque. Speed-reduction ratio is 4242.4 to 1. It is driven by a single-phase, 60-cycle, 115-volt, 1725-rpm, capacitor-run, capacitor-start motor, furnished with 3 leads, and is reversible up to 20 times per minute.

A double-output shaft is provided with this unit, at right angles to the input shaft. One side of the double

MACHINE TOOL BUILDER CUTS COSTS 26%

. . . increases rigidity with welded design

By James A. McCallum, Plant Superintendent
American Broach and Machine Company
Ann Arbor, Michigan

Heavier tool pressures, higher cutting speeds and closer work tolerances in modern machine tools require designs having greater inherent rigidity. In many cases, where the size and weight of a particular machine tool is limited, the increased strength must, of necessity, be gained through more efficient use of higher tensile metals. With welded construction, the engineer has at his command new freedoms of design, allowing him to place the right amount of metal in the right places and, at the same time, lower manufacturing costs by using less material, eliminating pattern expense and simplifying machining and assembly.

Typical benefits gained by converting machine tool designs to welded construction are illustrated in the fabrication of the main column for a vertical broach at the American Broach & Machine Company (Fig. 1). To eliminate the delays of preparing patterns and castings and speed delivery, upright members (Fig. 2-3) are now being fabricated by arc welding. Because of the uniform quality and thickness of the steel components, less metal needs to be machined from the fabricated assembly, cutting both shop time and tooling costs.

Savings in cost on the column member average 26% excluding an estimated cost of $2000 for patterns that have been eliminated as well as one week's time for snagging and filling castings. By cutting 6,000 pounds from the weight, reduced shipping costs are helping to lower the prices quoted to our customers.

Fig. 1. *Surface broach for the American Broach & Machine Company, Ann Arbor, Michigan. Capacity 40 tons, height 15½ feet, weight 34 tons.*

Fig. 2. Greater rigidity with less weight. *Welded steel is 3 times stronger, 2½ times stiffer than cast iron, saves 6,000 pounds of metal on this main upright column member.*

Fig. 3. Modern streamline appearance. *Component parts are cut and formed to shape before fast, simple downhand welded assembly.*

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shaft drives a limit switch. A 2½-in. handwheel operates a clutch for disconnecting the motor and the first reduction worm gear. The output shaft can thus be turned to permit adjustments of the driven apparatus. *Janette Manufacturing Co., Chicago, Illinois.*
(MORE DATA? CIRCLE FYI 96, p. 197)

Car-door opener has a large, positive-locking safety hook, which cannot become detached in operation. It can be swung 180°, but locks itself in place when assuming the pulling position. The end of the operating chain has also been provided with a safety hook, equipped with a latch, to prevent accidental release. The pawl can be automatically unlocked for chain stripping during operation. Known as the Model H, its price is $29.50.—*The Nolan Co., 279 Pennsylvania St., Bowerton, Ohio*
(MORE DATA? CIRCLE FYI 97, p. 197)

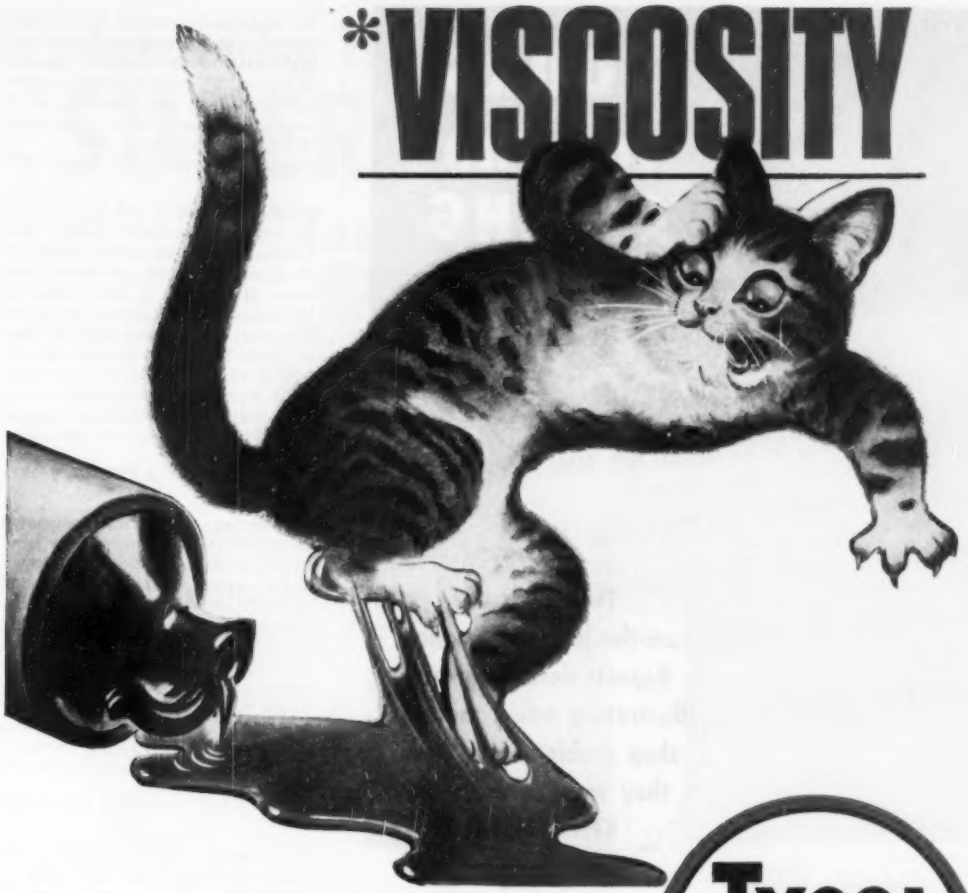
Dry-air pump is electric-motor driven and so designed that it will deliver ½ cfm, at inlet suction of 4-in. mercury and outlet pressure of 1-in. mercury. A vaned positive-displacement rotary pump, it requires no external source of lubrication. It is designed to operate through an ambient temperature range of from minus 65 F. to plus 140 F.—*Aero Equipment Corp., Bryan, Ohio*
(MORE DATA? CIRCLE FYI 98, p. 197)

Anvil converts any standard dial indicator with solid contact point into an indicator which will be resistant to damage from sudden impact. The tread size on the indicator point is No. 4-48 which is AGD standard. An internal spring serves to cushion shocks and blows from the indicator. —*L. S. Starrett Co., Athol, Mass.*
(MORE DATA? CIRCLE FYI 99, p. 197)

Buffing and coloring componnd, designated as No. 4-S-10, is said to be easily cleaned off after polishing. Aqueous solutions using a mild alkaline cleaner will do the job. It is especially useful in work with deep filigrees which tend to trap the composition.—*Hanson-Van Winkle-Munning Co., Matawan, N. J.*
(MORE DATA? CIRCLE FYI 100, p. 197)

Plastic pipe has a tensile strength of 5100 psi and a flexural strength of approximately 9600 psi. Burst pressures range with pipe diameter (a 2½-in.-diameter section has a burst pressure of approximately 900 psi.) These features make it suitable

*VISCOSITY



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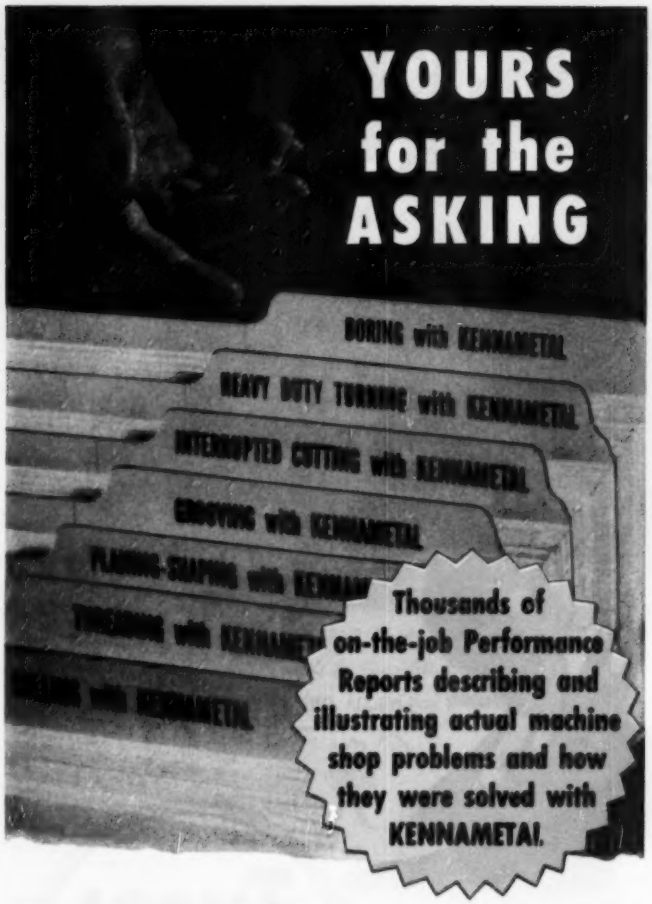

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for installations where high resistance to impact as well as moderately high pressures are required. Known as Carlon "L" it is furnished in standard pipe sizes and random 20 ft. lengths.—*Carter Products Corp., 10267 Meech Ave., Cleveland 5, Ohio*
(MORE DATA? CIRCLE FYI 101, p. 197)

Oxidizing liquid is said to act rapidly and produce better results than ordinary chemicals such as Sulphuret, Liver of Sulphur, or their substitutes. By adding ¼ fluid ounce of the concentrated liquid to each gallon of water, an oxidizing solution may be made for copper bronze, and silver. It will not deteriorate and there is no waste. Faster operation is obtained with a hot solution.—*Hanson-Van Winkle-Munning Co., Matawan, N. J.*
(MORE DATA? CIRCLE FYI 102, p. 197)

Hard-facing electrode, designated as EutecTrode 10, deposits a bead having a hardness of 63-68 Rockwell C. It is well suited to the hard facing of roller cams, rolling dies, pulverizing rollers, and similar items. One of its outstanding properties is said to be its ability to withstand higher temperatures, its red-hardness being above that of most conventional alloys. It is available in ⅛, 5/32, and 3/16-in.-diameter rods.—*Eutectic Welding Alloys Corp., 40 Worth St., New York 13, N. Y.*
(MORE DATA? CIRCLE FYI 103, p. 197)

Skip tote box has trunnions for convenient handling by fork truck or crane. The box is of corrugated all-steel construction with welded joints. The slanted end is reinforced with steel braces. Boxes are built to any size required, and load capacity and color of paint may be specified.—*Palmer-Shile Co., 16019 Fullerton, Detroit 27, Mich.*
(MORE DATA? CIRCLE FYI 104, p. 197)

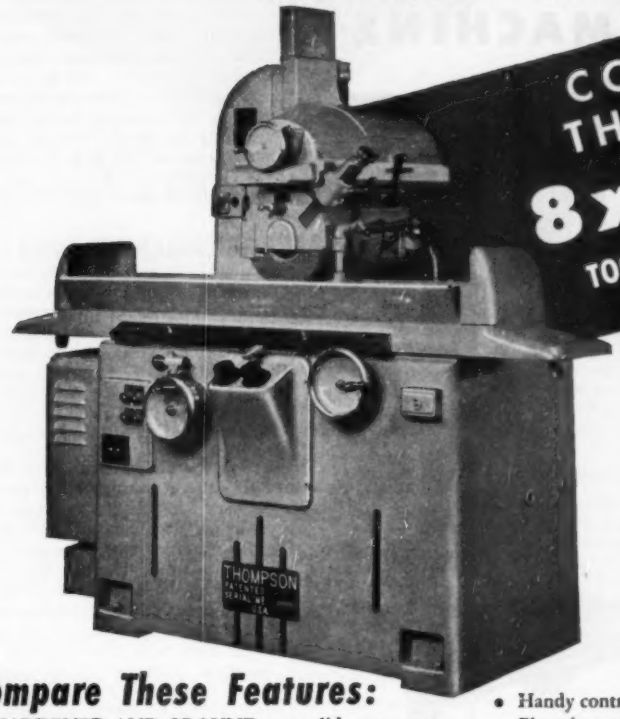
Pullers have threads on the forcing screw which are said to provide 32% more power than the conventional V-type thread. Fourteen sizes are available in two- and three-jaw models, ranging from 3¼ in. to 36 in. reaches.—*Owatonna Tool Co., 383 N. Cedar St., Owatonna, Minn.*
(MORE DATA? CIRCLE FYI 105, p. 197)

Screw driver is equipped with a screw holder in the form of a spring clip which may be slid back up the shaft and out of the way when not needed. To secure a screw to the driver, the clip is moved forward along the blade until the end of the

Announcing The New Thompson Type 2F

SUPER PRECISION

Tool Room Grinder



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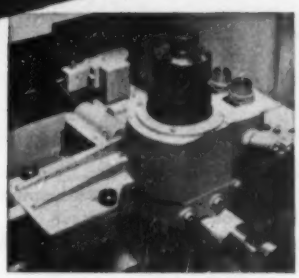

MAGNIFIED TEMPLATE DIAMOND WHEEL DRESSER with ten to one magnification available in universal manually operated and electric. Other auxiliary Thompson Type 2F equipment includes "Coolant Thru the Wheel" feature and Magnetic Chucks with control.

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- HARDENED AND GROUND cross slide ways completely sealed.
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- Elevation micrometer stop graduated in .0001".
- GROUND THREAD FEED SCREW.
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- Longitudinal hand wheel with automatic engagement.
- Hydraulic head movement throttle with rapid traverse.
- Hydraulic table movement throttle.
- Elevating hand wheel graduated in .0005".
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Thompson SURFACE Grinders

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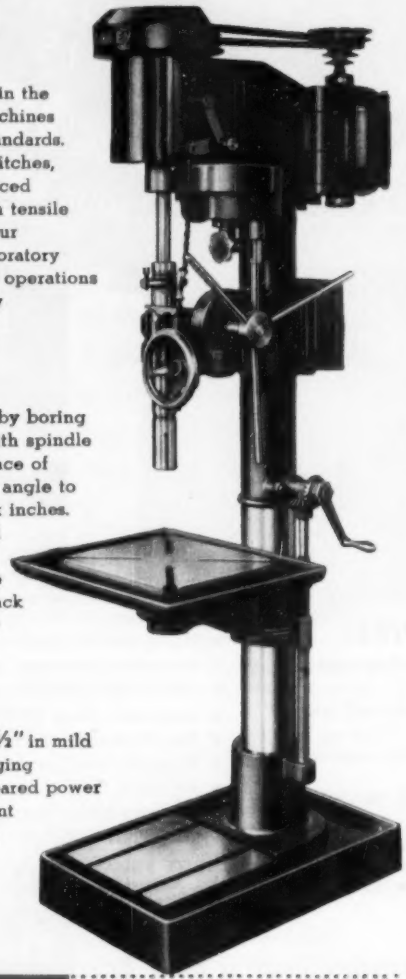
MODEL C-30

DRILLING MACHINE



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Over 70 years experience in the manufacture of drilling machines provides highest quality standards. All parts except motors, switches, V-belts and bearings produced within our own plants. High tensile strength castings made in our foundry under constant laboratory analysis control. Machining operations and assembly performed by master craftsmen.

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Table alignment is assured by boring table arm after assembly with spindle furnished on machine. Surface of table is maintained at right angle to spindle within .0007" in six inches. Spindle is precision ground and equipped with two ball thrust bearings. Spindle driving sheave and large back gear are each supported by two ball bearings.

FEATURES

20" swing; power to drill 1½" in mild steel; 8 spindle speeds ranging from 65 to 1360 R.P.M.; geared power feeds; simple and convenient controls; automatic spindle stop; rectangular oil groove table; powered by a 2 H.P. motor.

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clip extends beyond the bit. The clip is then inserted into the screw slot by exerting pressure on the spring to close the gap between the clip and bit. It is said to be equally easy to extract a screw through sense of feel and light pressure.—*Vaco Products Co., 317 E. Ontario St., Chicago 11, Ill.*
(MORE DATA? CIRCLE FYI 106, p. 197)

Magnetic separator removes miscellaneous tramp iron from wet or dry material in process. Known as Perma-Plate, Types 1, 2, and 3, they are made in 19 standard sizes from 4-in. through 72-in. wide, and in 2-, 4-, 6-, and 8-pole styles. They are also available in self-cleaning models which are fully automatic.—*Dings Magnetic Separator Co., 4740 W. Electric Ave., Milwaukee 46, Wis.*
(MORE DATA? CIRCLE FYI 107, p. 197)

Metal cleaner and polisher is available in the form of impregnated pads. The pads are said to be reusable until worn out, without diminuation of their cleaning and polishing effectiveness. Known as HiGlo each can contains 12 pads. Price—65 cents.—*Regal Air Corp., New York, N. Y.*
(MORE DATA? CIRCLE FYI 108, p. 197)

Portable drum racks feature tilting and positive locking in any position for easy accessibility and maximum drainage. The drums are held secure to the rack by toggle locks and a steel retaining band. There is also a stationary model, both racks being designed for 50- to 55-gal-drum capacity. The portable weighs 72 lb, is 45 in. high with drum upright, and requires 31x35-in. floor space.—*Penco Engineering Co., 725 Second St., San Francisco 7, Calif.*
(MORE DATA? CIRCLE FYI 109, p. 197)

Shop-box trailer, of corrugated design, has trunnions with a yoke for quick unloading two stationary wheels, and two swivel casters. The trailer hitch permits joining of several boxes to form a train. Units are of all-steel welded construction and are built to customers' specifications, including load capacity and paint color.—*Palmer-Shile Co., Detroit, Mich.*
(MORE DATA? CIRCLE FYI 110, p. 197)

Shop lamp utilizes an Alnico permanent magnet base with a 50-lb. pull. A universal ball and socket and a swivel arm support the lamp and permit positioning of the light to almost any angle. A rayon insulating coating on the outside of the shield permits the operator to work close to

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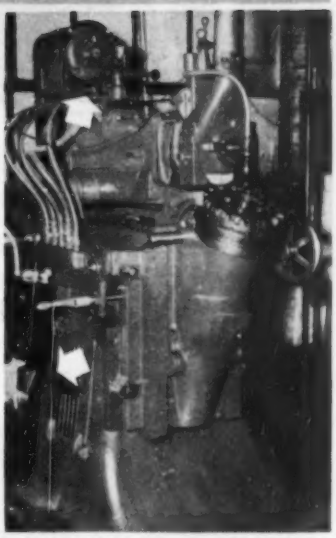

Two Century Squirrel Cage ball-bearing motors drive an automatic milling cutter grinder.

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- Synchronous — 20 to 150 HP
- Split Phase Induction — 1/6, 1/4, 1/3 HP
- Capacitor — 1/6 to 20 HP
- Repulsion Start Induction Brush Lifting — 1/2 to 15 HP

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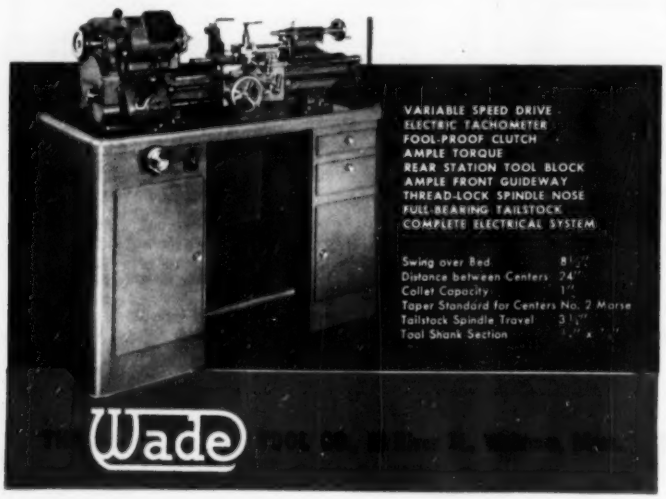

the lamp without burning himself. Known as the Model 200 Handi-Lite it comes with an extra bulb at the price of $7.50—*Enco Mfg. Co., 4522-24 W. Fullerton Ave., Chicago 39, Ill.*

(MORE DATA? CIRCLE FYI 111, p. 197)

Soldering flux, in liquid form, is said to eliminate practically all of the cleaning and burnishing of metal parts usually necessary before a soldering job can be done. Known as Divco No. 229, it is packaged in a 4-oz. squirt can. Price—50 cents.—*Division Lead Co., 836 W. Kinzie St., Chicago 32, Ill.*

(MORE DATA? CIRCLE FYI 112, p. 197)

Automatic lubrication for stamping and forming of roll, strip, and sheet stocks has been developed. The system is said to insure complete lubrication coverage of both top and bottom of stock, even when heavy lubricants are used. The constant circulation is said to keep emulsions of soluble oils well mixed, and flush off dirt and rust particles.—*Graymills Corp., Evanston, Ill.*

(MORE DATA? CIRCLE FYI 113, p. 197)

Tread material for industrial wheels is composed of macerated canvas-duck impregnated with phenolic resin; formed under pressure in precision molds to insure concentricity and balance. It is said to be resistant to all common fats, acids and greases, and to be practically indestructible. It is bonded to an aluminum-alloy hub. Called Resitred it is available now on Aerol, Aerol-Seal and Airlite wheels.—*Aerol Co., Inc., 2829 Ontario St., Burbank, Calif.*

(MORE DATA? CIRCLE FYI 114, p. 197)

Polishing belt lasts for more than 1,000 set-ups, suffers no raveling, has negligible stretch or shrinkage. A special splice joins the belt, insuring smooth-running operation without kick. *The Industrial Lubricants Co., Inc., 14459 Wildemere, Detroit 6,*

(MORE DATA? CIRCLE FYI 115, p. 197)

Micro-drill-jig bushings and liners in a line of over 1700 types is being offered. Bushings are from 0.0135 to 3/32 in., and in four standard body sizes (3/32, 1/8, 5/32, and 3/16-in). Liners for all body sizes are also included in the line.

Some features: bearing for drill extends the full length of the bushing, giving better drill support. Bores of all bushings are accurately lapped from plus 0.0000 to plus 0.0002 in.

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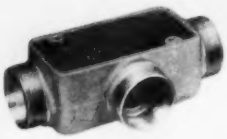
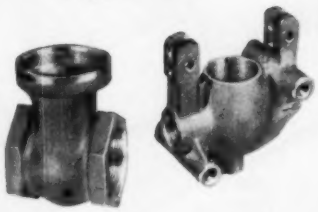
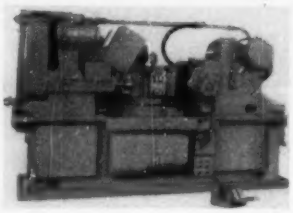
This NEW development—unsurpassed for speed, convenience of tooling and precise finish—involves no retooling problem even for short runs. It assures greater production at lower cost on all classes of work.

The unique "1-2-3" feature, exclusive with Goss & De Leeuw, provides the means for performing one to three right or left hand single or double threading operations simultaneously or in sequence, without changing set up.

Here's an ideal machine tool for small lot requirements because of quick, easy changeover. Any class of chuck work can be handled economically in any quantity.







The examples of work shown here are typical of the wider variety of parts being produced on these new machines.

SEND FOR detailed information on this new machine. Let us have samples of your work in order to give you time and cost estimates for handling it on the "1-2-3" Goss & De Leeuw.

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Concentricity of bore with body OD is held within 0.0002 in. Bushing bores are chamfered. Press fits are 0.0003 in. to 0.0005 in., eliminating distortion of the bore.—*Micro Drill Guide and Engineering Co., 18515 Weaver Ave., Detroit 28, Mich.*
(MORE DATA? CIRCLE FYI 116, p. 197)

Hack-saw attachment is claimed to be lighter, more compact, cheaper, and more simply operated than any other such unit on the market. It fits any ¼-in. electric drill or drill press weighs 11 oz, is made of hardened, heat-treated steel. Unique design includes minimum torque action (no vibration), ¾-in. stroke, no gears or bearings (longer life), and greater safety, since the only exposed moving part is the blade. *Bertram Engineering & Supply Co., 3121 Main St., Kansas City, Mo.*
(MORE DATA? CIRCLE FYI 117, p. 197)

Medical detergent removes oil and grease from industrial injuries. Called S.S. Spray, it is automatically dispensed from a hermetically sealed bottle. It may also be used for the removal of ointment dressings and as a detergent for soap-sensitive skin.—*The Gebauer Chemical Co., 9410 St. Catherine Ave., Cleveland, Ohio*
(MORE DATA? CIRCLE FYI 118, p. 197)

Electric switches of small size and snap action are being produced, wherein the switching action is independent of the speed of the actuator. Double-break contacts provide two separate circuits. The standard model is a single pole, double-throw type, designed for ac circuits. The switch may be wired single-pole; double throw; two-circuit; normally closed or normally open.— *Electro Snap Div., The Ezhibit Supply Co., 4218-30 W. Lake St., Chicago*
(MORE DATA? CIRCLE FYI 119, p. 197)

Electric powerguns, of 25- and 40-lb capacity, give pressures up to 5000 lb, and include a 115-v 60-cycle universal motor with heavy-duty switch that shuts off automatically when that maximum pressure is reached. The light model delivers 14 oz of light or medium lubricant per minute at 70 degrees F, and the heavier, which handles all types of grease, delivers 5½ oz of heavy fibrous lubricant under the same conditions. *Alemite Div., Stewart-Warner Corp., 1826 Diversey Pkwy., Chicago 14, Ill.*
(MORE DATA? CIRCLE FYI 120, p. 197)

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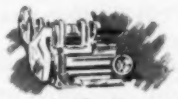

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ROUND TABLE Discussion

EMPLOYMENT PREVIEW

IN A SMALL WORKS employing fewer than a hundred hands there should be no need to employ a personnel officer. The chief foreman, if he has the experience that his job calls for, should be ideal for the task, and since the labor turnover in such a plant would, naturally, be small the demands on his time in this connection would be correspondingly few. In a large works a personnel officer is a necessity, but his province should be clearly defined at the outset. It is the writer's experience that one specialist for engaging *all* hands for a large works employing different grades of labor and often skilled men of different trades, just does not work. A large modern engineering factory, for example, may employ fitters, turners, machinists, electricians, blacksmiths, joiners, plumbers, coppersmiths, tinsmiths, etc., while a shipbuilding yard will employ all those tradesmen plus platers, carpenters, caulkers, riveters, and welders; in short, almost every trade will be employed if first class passenger and mailship work is undertaken. Nevertheless, a personnel officer is a necessity in the large modern factory or shipbuilding yard. His part is to hunt for the class of labor required by the chief foreman of each department. Those foremen really are the specialists in selecting suitable labor for their own departments and not much time is taken up with interviewing if the personnel officer does the spade work of getting likely applicants forward for interview. The usual procedure over here is to draw up a printed form concerning all classes of labor employed and to furnish each chief foreman with a number of those forms. The form consists mostly of a number of questions regarding the type labor and qualifications required, the answers to which are filled in by the foreman concerned. The idea of the printed form is, mainly, to reduce to a minimum the amount of time the foreman must spend in hiring labor.

From the foregoing it will be seen that the employment of a personnel officer relieves the chief foremen of much preparatory work which can be equally well done by any intelligent office man. Interviewing the applicants, however, is another and more important matter which can only be

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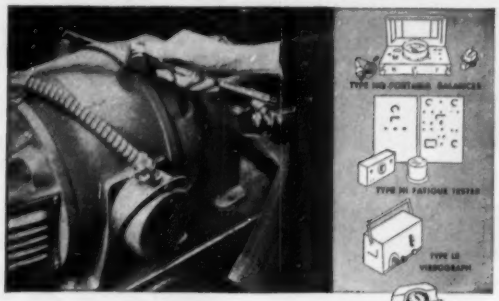

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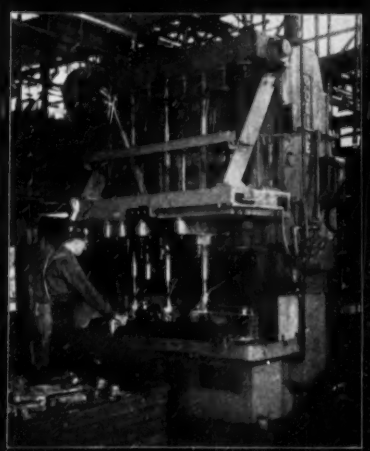

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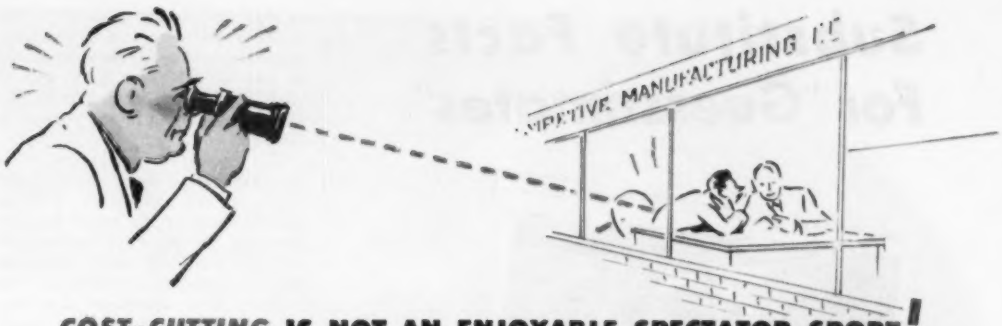
successfully performed by one who has an expert knowledge of the job in view and is therefore best qualified to judge which of the applicants is most likely to fill the bill. After all, since the foreman is the person responsible for getting the work out at the door, it follows that he should be the person to decide who should lend a hand. If that important decision is left to the personnel officer the chief foreman cannot, in fairness, be held responsible for the results of the hired man's labors, and that is where the trouble begins. On the other hand, if the decision is left to the chief foreman, he can blame no one but himself if a poor selection has been made. In the case of the applicant, it is much better in his own interests that he should be interviewed by someone who can put a value on his experience and who will be in a position to make clear to him what, exactly, will be required of him in the matter of skill and production speed.

An agreement concluded by the two parties most interested in the transaction lets each know just where they stand and reduces the possibility of misunderstanding and dissatisfaction so often present if the decision rests with a third party. In the case of a man in employment but seeking a change, it is even more desirable that the foreman should be completely satisfied of his ability to deliver the goods, since it is always a distasteful duty, dispensing with the services of a man who has left other employment, presumably to improve his prospects in life. There is a further argument in favor of a foreman selecting his own men; the men who come for interview soon sense if the interviewer knows the job concerned and are more careful about their replies. The chancer thinks twice before replying to a question and attempts to conceal as much of his lack of experience as he can, while the good tradesman responds to obviously informed questioning by expanding and telling all he knows. The difference is that one has something to hide and the other has something to sell. The good foreman who has been through the mill finds little difficutly in spotting the chancer.

C. D. Mackinnon
Airdrie, Scotland

•

THE QUESTION as to whether labor should be engaged by the foreman or by a specialist is a moot point. It is often treated as an abstract matter; as something which can be done to rule and as well by one man



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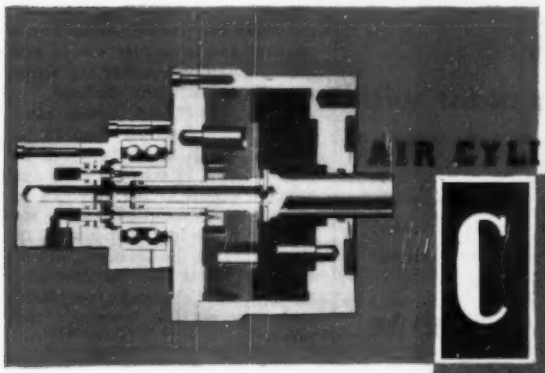

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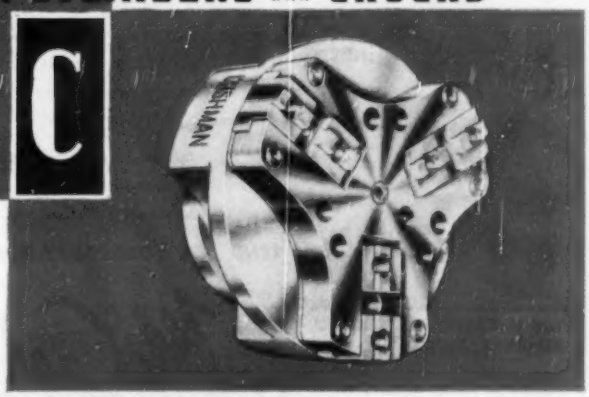

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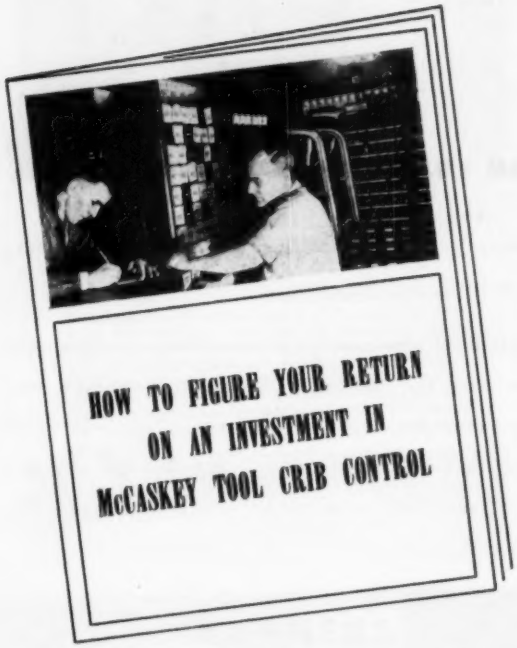

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as another. If this approach to the problem be correct, then any suitably chosen man of good character should be able to fill the bill. It will be wise, however, to make certain that this interpretation of the position is correct.

The choice of machinists is at least two-fold in character. The judgment of the candidate's personal qualities and of his production experience. To select and engage calls for knowledge which none but a man with a foreman's experience can hope to have. Questions of a technical character need to be asked, the answers to which call for the consideration of a trained brain. The writer remembers some years ago the complaint of one of your contributors; he had been sent a lathe hand whose knowledge of the lathe appeared to be confined to "having, at some time, walked past one." At one time, a universal grinder was wanted. One was sent and he was a universal grinder all right, but not on a precision machine. He could work on large and small stones (wet or dry), could fettle any kind of forging or stamping, but knew most about knife stampings. He sat on a seat athwart a sandstone: a universal grinder.

In one works the specialist's basic thought seemed to be that males and females could be distinguished by the attire they wore; either breeks or skirts and in no case was he ever known to engage one of the wrong sex. But how many duffers!

The person hired means much more to the foreman than to the specialist; it is probably better for the specialist to select, and to submit the cream to the foreman for definite engagement. Then the specialist will be free from blame, the onus being on the foreman; and the Boss will know that his new labor will have been chosen by two officials and some of the foreman's time saved.

P. E. James
Lindum, England

•

TELEVISION EYES

Of course, it is wrong of Thompson to stay out too late at night so his eyes get bleary and his feet tired. But how does Ed know this is the reason when he has not even talked to him? Perhaps Thompson is sick from the years when he worked night and day to help defeat the enemy, or maybe he has a son who died in the war so that Ed may work and live in peace and liberty. It is also possible that his wife or children are

Drilling a $\frac{60}{100,000}$-inch diameter hole *(half that of human hair)* on a standard

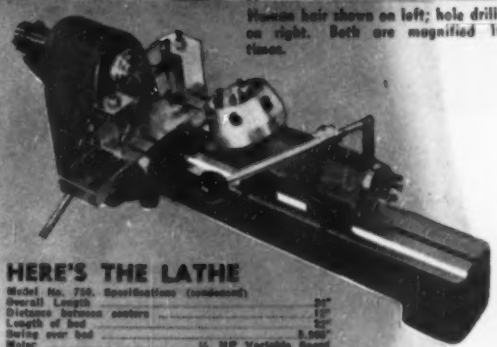
DERBYSHIRE *"Elect"* LATHE

Human hair shown on left; hole drilled on right. Both are magnified 108 times.

Smallest hole ever known to have been drilled in metal in this country

This remarkable piece of work reflects the high technical ability of the operator in the U.S. Naval Ordnance Laboratory, White Oak, Md., where it was performed as well as the outstanding precision of the Derbyshire "Elect" Lathe used in the drilling operation. The hole was drilled in a platinum part for the hydraulic system of a new Navy weapon. Only through the use of an electric ohmmeter could the operator tell when contact had been made between the drill and the platinum. The drill was attached to a combination tailstock and centered by means of a microscope. To the best of our knowledge, the microscopic opening, half the size of the smallest hole drilled commercially, is the smallest ever to have been drilled in metal in this country.

Full details on Derbyshire Precision Lathes are available on request.



HERE'S THE LATHE

Model No. 750. Specifications (condensed)

Overall Length	24"
Distance between centers	12"
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Motor	½ HP Variable Speed
Spindle Speed (Max.)	12,000 RPM

Semi-Automatic Turret with ⅝" bore
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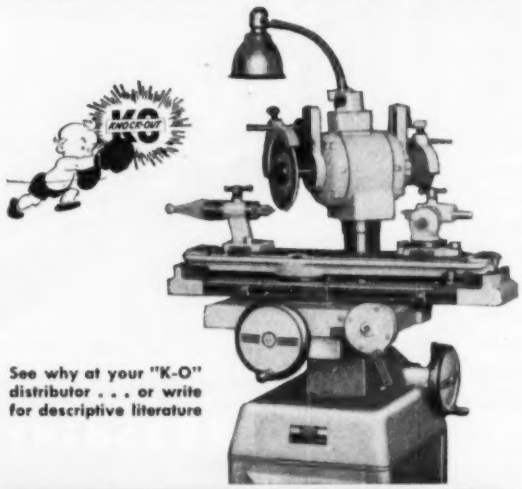

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ill. Or perhaps Ed has given him a job that is under his dignity to appreciate.

Al is perfectly right when he suggests that Ed ought to find out through the Personnel what is the matter with Thompson. That's their business.

If I were to handle this case myself I would call Thompson to my office, ask him to sit down in front of me, and talk to him straightforward to find out what ails him. If his explanation was suitable to me I would try to help him; if not I would give him a warning, and if he did not improve I would give him a second warning. Probably before I fired him he would leave on his own accord.

It seems to me that Ed has learned nothing from the past ten years' changes that have taken place the world over, and he is perhaps one of the type of foremen that used to merit themselves through the hire and fire method. But that era has now passed never to return. If Ed cannot adjust himself to the new policy towards the working force now necessary, he is not the right kind of a foreman best suited in our times.

A man's private business is, of course, his own concern so long as it does not affect his job, and the community in which he lives. But an employer is perfectly justified to inquire about the welfare of his men when efficiency at any point in his shop is going down. Ed should not fire Thompson until he has found out the reason of his deficiency and then only if he could not accept the explanation, and after giving him two warnings.

Concluding, I like to say that the best thing Ed can do to promote a widespread of socialism is to kick out

"He likes to rib the boss about where this tight labor situation will lead."

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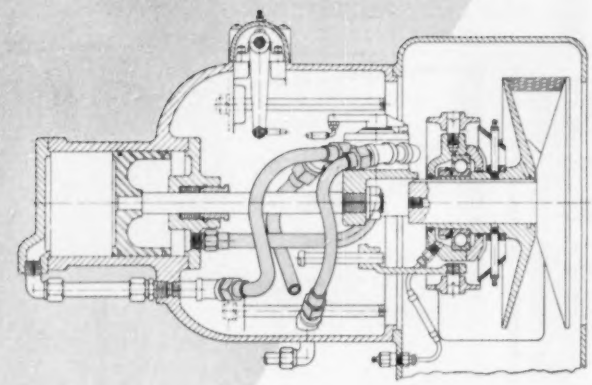

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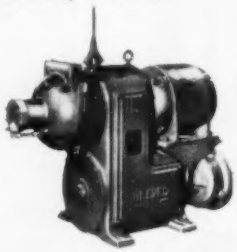

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anybody in his shop for whatever small reason, and to take the bread out of the mouth of any man whom he thinks deserves it.

The reaction in the long run will probably be the reverse to what Ed expects. It is very dangerous now to practice the old type of discipline and pretend as though the worker only had the right to die for his country, nor that he does not understand who's life, liberty and property he is protecting in doing so. I think any employer should do his utmost to straighten things out between himself and his workers, and look over his foremen to see that they carry out that policy properly.

A. E. Fristedt
Stockholm, Sweden

•

OVER HIS HEAD

IN WHAT would be considered the best organization, suggestions for improvements would be expected to be given to the one from whom he receives his order: that is, a workman would talk things over with his foreman.

However, a foreman should not be too sensitive, as some people may think differently on such matters through a hasty or careless remark without much thought of results.

If it is done deliberately there is no valid excuse.

Outcomes of human nature are varied and peculiar and a foreman has to contend with all kinds.

A higher ranking officer should not ignore a suggestion wherever it may come from. If from a middleman, he should confer with both the foreman and workman assembled together and get all of the facts as well as a thorough understanding among all concerned before making a decision in such matters.

Abel Blakeman
Watervliet, N. Y.

•

VERY OFTEN it is the foreman's fault when the employee goes over his head. The foreman should know every man wants some kind of recognition. If we recognize some good quality in the employee he will not go elsewhere to get attention. Every man has some good quality and if we work on the good qualities we will have no trouble correcting the faults.

We all like that feeling of importance—be we the boss or the fellow who sweeps the floor. There are other foremen who ignore the small gripes which cause resentment in the employee. He then goes to someone

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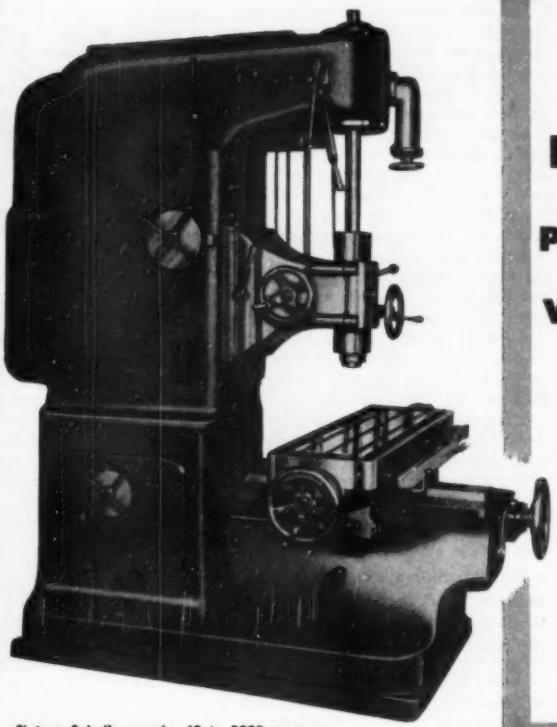

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else who will listen. W must pay the small complaint or gripe the same attention we would a grievance. The little things sometimes do the greatest injury. If we pay attention to all complaints no matter how small we would save ourselves many a grievance which goes up front. In my opinion every employee should be given the opportunity to express ideas and opinions on how the job has to be done. Give him the opportunity to express his point of view. Encourage him to turn in suggestions and help him with any sketches on new fixtures.

Let each employee have a turn on the safety-committee. If there is a sick benefit in the plant encourage your employees to take an active part in it. These methods will make the man feel a part of the job and at the same time feel important. If we can do these things we need have no fear that the employee will go over our heads. We do however find an occasional employee who likes to show off or thinks he can get in solid with the top brass. In this case we cannot be overindulgent. We must tell him firmly that you expect him to come to you unless it is something you cannot handle. If the employee wishes to see the big boss at any time he must first get the foreman's permission. In the final analysis the foreman must consider "what's right" not "who's right". If he does this he need not fear the employee going over his head.

A. E. Salmons

•

THERE IS a saying, "The truth is the best lie," and that goes for everything, even in spoiled work or jobs, where some mistake was made. Every man that does work is liable to make a mistake. The smart man is benefiting by his mistakes; only a fool repeats them. No boss that has confidence in his men likes some one to come and tell him that men he trusts are doing something that is wrong.

As far as you did not want to bother or worry Robertson with details, my dear Ed, you did worry him much, much more by not telling him about the mistake that was made. If you had told him that some mistake was made and it could have been rectified, he would not have worried, as he probably knows that you can and are capable to do things the right way, and that you can correct things that are not right.

As far as concerns Tom going over your head again, it is your fault, no one else's. The way you have your men trained, if you and your men are on the up-and-up with each other, you will have their respect, and no one will go over your head. But when you are not, and do things that are not an up-and-up way, trying to cover things up, then surely, you can't blame Tom to go over your head.

When a man that works for you does make a mistake, take the man into your office and give him a good talking to, to find out why the mistake was made. Show the man that you are there to help him; show him you are interested in him and in his welfare, also that you yourself have a job to do. If it was careless on the man's part, tell him that mistakes can happen, but that if he makes more mistakes he will not be working for you long. Then all the men in your organization will know that you play fair with them, and I am sure no one in your gang will go over your head.

Now, let's say that Tom Jones is one of those smart fellows that is trying to play politics or trying to get in solid with the boss, or the big shot. If you would have told your boss about Tom, he would have told Tom to go and peddle his rotten apples somewhere else. That would have put Tom in his place, there and then. You would not have to have a row with him, and your men would have taken care of him after that. He would not feel comfortable to work in your organization with the rest of the men. On the other end, Tom was probably talking to Robertson, or better said, Robertson was talking to Tom, and it came out about the sloppy work without any ill feelings. Again, it is you, not Tom that is at fault for not being straight-

"Something's got to be done with that wall . . . it's driving me crazy."

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OH-H-H! WHAT YOU SAID!
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LUNKHEAD DON'T KNOW ONE FILE FROM NOTHIN'!
BLUSH
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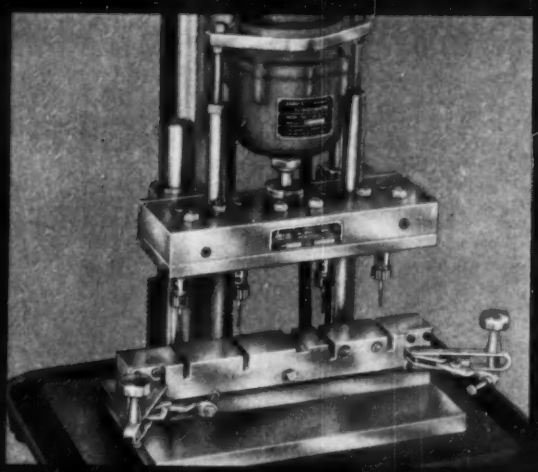

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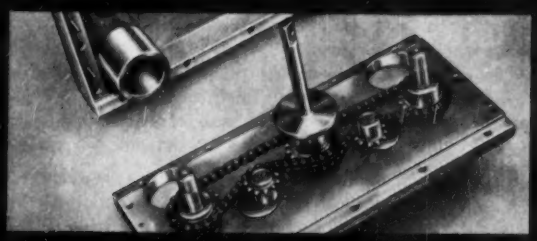

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forward. You know that you are not doing the right thing, therefore, you are afraid of it, and you feel guilty, and Robertson knows you so he will try to pump any of your men for information to find out what is going on in your department. He is the big shot because he knows his men that are working under him who he can trust, and who he can not. You in his place would be worse than him. I would not like to work for you. Honesty is the best policy now and always. Be honest with yourself and with everyone else, and you will be better all around. Respect others and they will in return, respect you.

Michael Axler
New York

•

I AGREE with Ed there is no excuse for Tom to go to the Superintendent to complain about a fixture. This is none of his business. But if Tom had told Ed about the trouble without result, then his action would have been justified. Yes, it certainly puts Ed in a heck of a position, especially if Tom is doing this often. I don't see why Ed should have spoken to Robertson about such an happening. No, it is up to Robertson to tell Tom to take the matter up with Ed, and Ed should, after a talk with Tom, take the matter up with Robertson, or Robertson ought to have told Tom to settle the matter definitely with Ed.

Now, if the matter is not straightened out in this way it may be because Robertson is looking for a chance to get at the foremen serving under him. There are many superintendents whose ability is so limited that they themselves think they can better their own position by blaming the foremen. Perhaps Robertson got his merits through talking? If that is the case the manager ought to step in and tell him how to handle a case of this kind.

I don't believe any man in the shop should talk to the superintendent about anything that has to do with work unless his foreman has first been informed. On the other hand anybody in any shop ought to have the right to speak to the superintendent or even the manager or the president about personal or social things, without first reporting to his foreman. But, of course, there is one exception. If Ed is collecting a lot of ideas from his men and uses them for his own benefit, then anybody under him should have the right to go "upstairs," but if I understand Ed right this was not the issue.

If I had been in Robertson's place

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Here's another "good company" friend of Maxitorq, the Pneumatic Scale Corp., that has selected our No. 23 Single Clutch as original equipment in their most ingenious Heat Seal Tea Bag Machines.

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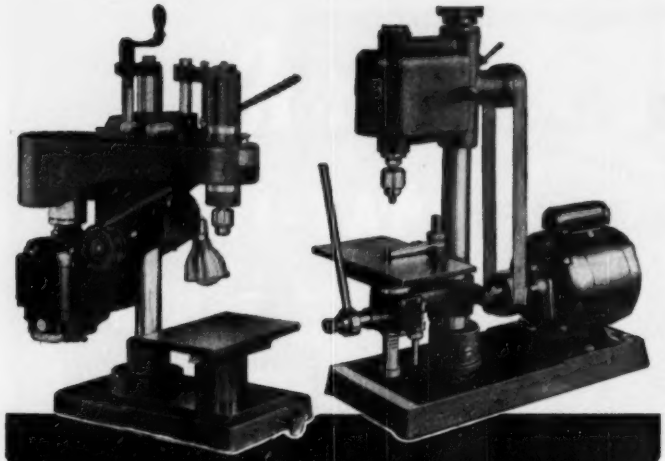

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"AS SPECIFIED"

At spots where small, precision holes must be produced on fast production schedules, and where no excuse for failure to produce "as specified" is good enough, the Hamilton line of small hole, super-sensitive drills and tappers enjoy the full confidence of the men who are charged with responsibility for getting the job done.

Year after year, 80% of the sales of these machines are to those who know them through use.

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I would have called in Ed and in his presence I would have told Tom what to do in a matter of this sort. That, I think, would give Tom a well needed lesson. Many men like Tom think they can go to the superintendent with anything, and if the superintendent has a weak character such men might cause irreparable damage to any foreman.

A. E. Fristedt
Stockholm, Sweden

•

THE FIRST, and probably natural, reaction to Ed's problem is one of righteous indignation. Just who does Tom Jones think he is, going over his foreman's head?

A little closer scrutiny of the problem shows up several factors that may put this heinous crime under a different light. Maybe Tom Jones has become "fed up" with taking his problems to Ed and receiving little or no satisfaction. There is even a good possibility that Tom isn't a "glory grabber" as Ed intimates. If Tom has the company's interest at heart, and has been getting no assistance from Ed in ironing out his daily problems, he may have a real kick coming. In fact, this appears to be an effective, if not too ethical, way of keeping the foreman on his toes at all times.

It may be that Tom didn't really go to the superintendent with his problem. Maybe the super was just walking around, talking to various men in the plant. If so, Ed has very little reason for feeling that Tom has gone over his head. It must be considered too that Ed has known there was trouble with the fixture, and hasn't seen fit to do anything about it.

In general, however, the practice of going over a superior's head is not to be recommended, except when all other means of obtaining satisfaction have failed. A good supervisor won't refuse to handle kicks and complaints; it's his job to act on suggestions, and deal with complaints in such a manner that the employee accepts his action and decision in good faith. If it happens to be a problem for which no immediate relief is available, it is up to the supervisor to not just tell, but to convince the worker of that fact. A good supervisor will do just that.

The act of going over a supervisor's head can often create an embarrassing situation for the worker himself. He may have no idea of the liaison work which has been gone into in any problem. Maybe steps have already been taken to correct the matter; if so, he may find himself getting a very cool reception from

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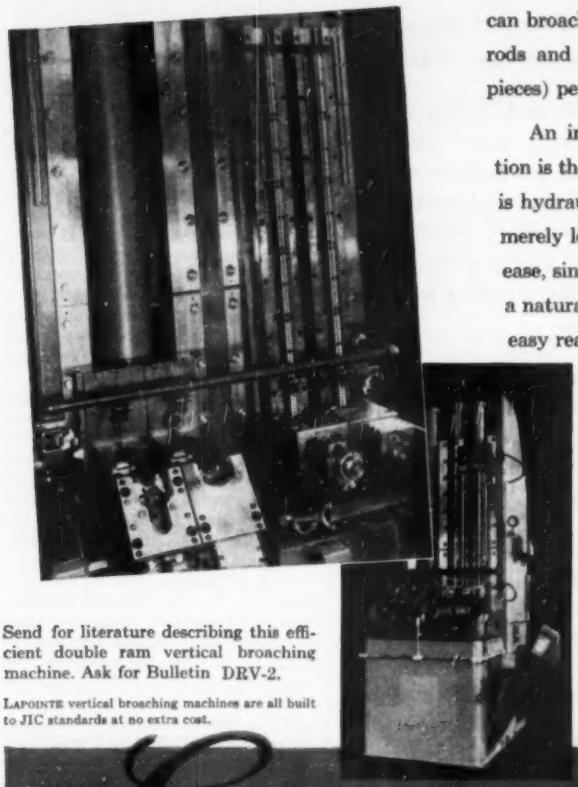
Operating at a cutting speed of 40 feet per minute, this 15-ton, 66-inch stroke special heavy duty

LAPOINTE DOUBLE RAM VERTICAL BROACHING MACHINE



can broach the half-round and joint faces on connecting rods and caps at the rate of 280 complete rods (560 pieces) per hour . . . at 80% efficiency!

An important reason for this outstanding production is the *exclusive* LAPOINTE Tip-Down Fixture, which is hydraulically operated and automatic. The operator merely loads and unloads. He does this with maximum ease, since the fixture tips toward him and he works in a natural, comfortable position. All controls are within easy reach.

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- Separate broach bodies for each part on each slide assure minimum maintenance time.
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LAPOINTE vertical broaching machines are all built to JIC standards at no extra cost.

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The Oliver ACE Universal Tool and Cutter Grinder

The Oliver ACE, like magic, will bring your toolroom greater production economies, faster and more accurate grinding, simple easy setups, and a wider range of cutter grinding with less fixtures.

The end result will achieve greater cost reduction and production betterment for less investment than other methods.

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higher authority when he broaches it.

In the final analysis it all comes back to one unescapable fact: A good supervisor can eliminate, or at least lessen, the friction arising from these affairs—if he keeps on his toes, and on the ball.

C. F. Dandareau
Detroit

•

BACK ON THE CLOCK

CAN IT BE that Al feels that he is a little better than the other fellows? If such is the case, his having to stand in line and take it with the rest of the boys is just what the doctor ordered to bring down the inflammation of his ego.

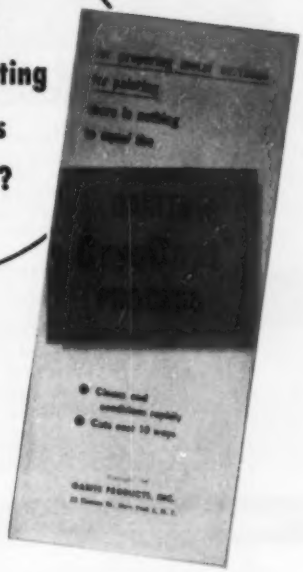
Punching a timeclock is a business deal and protects the salaried man just as much as the wage earner. The unfair part of it is that an executive does considerable work, of a mental nature, of course, while away from the plant. He'll gnaw on a dollar and a half steak at the same time trying to figure out how to save time in getting out the milling fixture that has to be delivered by the first of the month. Often he gets a stiff bawling out from his blonde bed-maker because he is unsociable at the table, whereas if the truth were known the poor guy is trying to dope out some difficult problem at the shop. Without the evidence of the clock he's likely to get a sound going over for being late at night—the hard-ridden executive does spend lots of time on the job outside of his regular hours.

Al and the rest of the foremen who have the same frame of mind must look at it in the light of future evidence for convincing the superiors that they have devoted considerable time on the job other than the stipulated amount. All executives should punch the clock—little shots, middle-size shots, and big shots.

If it so happens that the firm is a small one the clock stands as a sentinel of economy. I have so often seen a trustful employer gypped of time by imposing workers, that the injustice of it gave me the industrial willies. I have seen men come straggling in five minutes—ten minutes—fifteen minutes late, and then have the undiluted gall, at five minutes to five, to put on their cards full time on the job.

While I am on the subject of timeclocks I must mention a friend of mine who took over the managing of a large manufacturing plant. One of the first things he insisted upon was that everyone, from himself down to the shop sweeper, should punch the

Can you clean steel and condition it for painting for less than 20 cents per 1,000 square feet?



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When you attend the big METAL SHOW in Chicago, October 23 to 27, be sure to see the Oakite exhibit in Booth 322.

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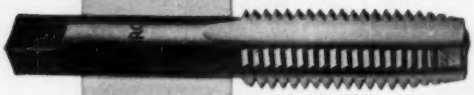

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clock. The clock was the only uncomplaining one around the place until about a year later the work's manager was offered a better job. I was particularly amused at the little clock drama that followed.

Regularly the manager arrived at the plant in the early stages of his administration—with the customary vigilance he entered with the earliest of the early ones and slammed down the clock lever with that sparkling determination to put in a full day. After he put in his resignation I couldn't help noting the daily lag in the big shot's efforts. My desk was so placed that I could see the clock from where I was sitting. The executive kept getting later and later as the time of leaving drew near. On time, five minutes late, ten minutes late, half an hour, one hour late, two hours late and so on until the fellow almost met himself coming out. All the time his card would be inserted with that staunch determination to uphold a principle that was strong in his makeup.

I was particularly amused, as were some of the others, during the last week of his reign. The vanishing big shot would pass by the clock and give the lever a stiff slam without even taking the trouble to insert his card. His idea was being maintained: the clock must be punched! I wish now that I had made an accurate record of the time as he entered the works during that period of evanescence as it might have been of value to others—and dear old heart-broken Al — whose services were drawing to a close.

John Homewood
Ontario, Calif.

•

WHO PICKS THE BOSS?

MANAGEMENT should pick the boss—always!

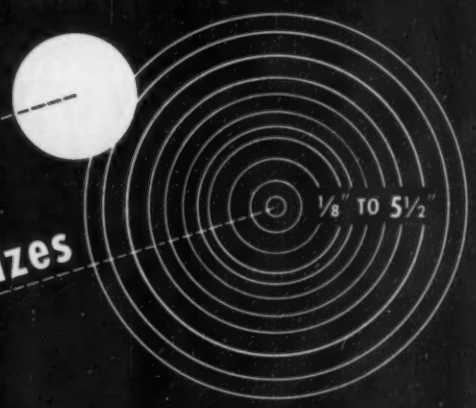
Workers now have control, through their unions, of their hours of work, their wages, conditions under which they work, and have guaranteed seniority, pensions, grievance procedure, as well as many other privileges. All of this with the approval of a paternalistic government controlled by well-fed politicians.

In many plants, a foreman can not discharge a workman for cause, without precipitating a strike. The daily papers are full of cases about foremen who have tried this. Nowadays, a candidate for discharge, must be properly notified several days in advance, the shop steward has to be informed, and the workman has a regular grievance procedure for presenting his side of the case. This

PRODUCTION

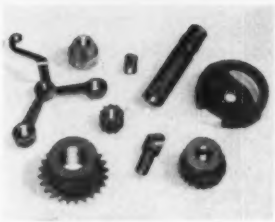
On One Hole Size . . .

Or Dozens of Different Sizes



SUNNEN HONING

- Saves Hours of Set-up and Production Time
- Produces Exact Size and Finish



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It's used for everything from de-burring to micro-fitting. One easy-to-use machine handles both long runs and short, with quick changeover from one hole size to another. Hones metals of all hardnesses except lead . . . hones carbides, ceramics, glass, plastics . . . all sizes from ⅛" to 5½" . . . open and blind holes . . . holes with keyways, ports and lands. Set-up time is about a minute between jobs. Many owners save the cost of the machine *on salvage jobs alone* — reclaiming expensive rejects from other operations.

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Material: 1020 steel
Stock Removal: .002"
Tolerance: ± .0005"
Production: 100 per hour (includes gaging)
Hardness: Rockwell "C" 62
Finish: 10 micro-inches

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In the country's leading plants you'll find job after job where holes are sized and finished at rates of 60 to 400 per hour. Stock removal ranges from de-burring to as much as .010 in some cases. Accuracy of .0005 is typical—can be held to 25 millionths. Sunnen Honing produces geometrically true holes, free from bell-mouth, taper and warpage, with surface finish to 2 micro-inches R.M.S. in hardened steel.

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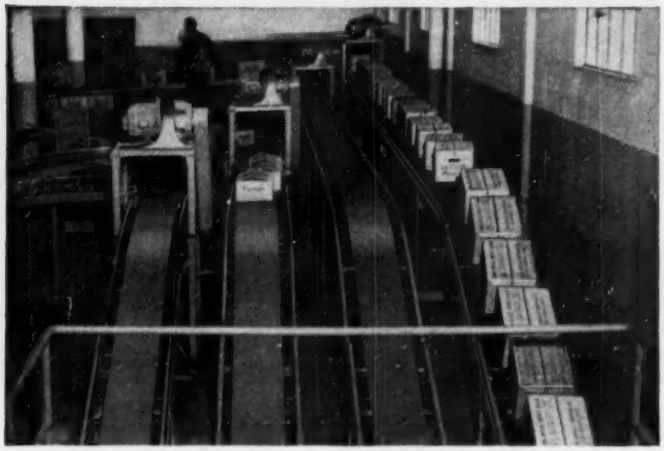

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means that a modern foreman has only a nominal control over his men.

Most unionized workers establish their own standards of production, occasionally fair, but mostly on the low side. If a foreman happens to be of the serious, mind-intent-on-work type, he is certain to be picked on by the run-of-mine brand of workmen as a 'driver', and will find his efforts to secure production sabotaged beyond hope of success.

The writer thoroughly believes in collective bargaining, in principle, and has a deep-grounded respect for that type of American workmen who intend to do a fair day's work—and do it—but want a fair day's pay for their labor. On the other hand, the writer also knows a great deal about the loafers, the shirkers, the run-of-mine, average jobholders, who have little to offer industry in skill, interests in improving their job qualifications or work efforts, but simply want the most for the least. And don't forget for one moment, there is no open season on these sub-marginal workers. They're here to stay, and no one is going to get rid of them. But let these men pick their own boss? No; I think not.

In bye-gone years, employers have always tried, and are still trying to build organizations of nothing but exceptional men. It can not be done, because there are not enough exceptional men.

Businesses exist to pay dividends—to make profits. Profits come into being when intelligent management takes its tools of capital, labor and materials, and so manipulates them against competition that they can create a profit on invested capital.

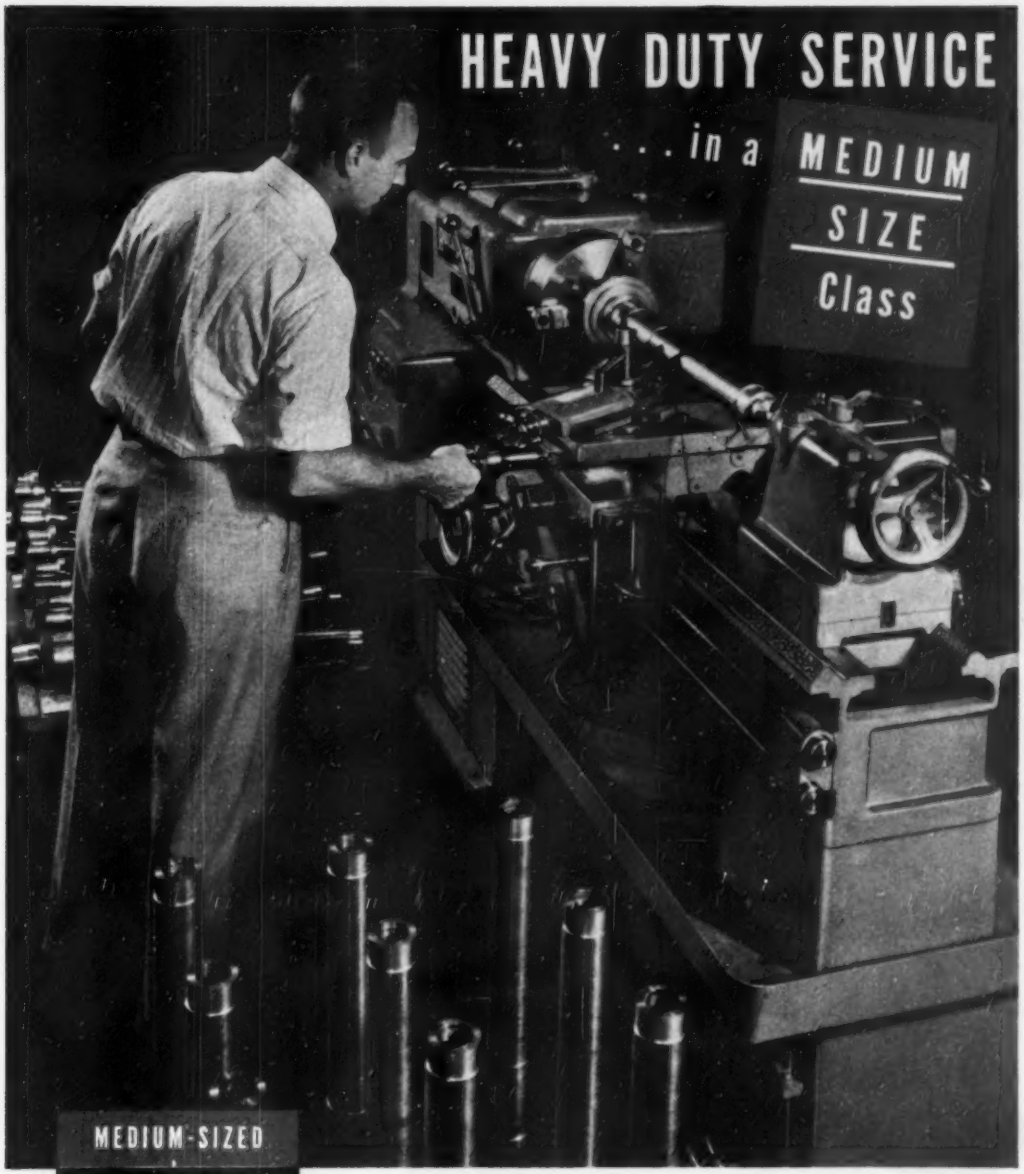
At present, management has a fair control over capital, is at the mercy of materials, and is fighting to maintain a token control over labor. If you let the men pick their own foremen, that means you let the sub-marginal worker—the least qualified to do it—make the rules, and you take away from management even their token control over labor.

In a very short time, the company will go out of business, and there will be no jobs for anybody.

James K. Matter
Detroit

•

MANAGEMENT should give consideration to the workers' viewpoints in the future selection of a new foreman. However, identifying and developing potential foremen is one of the most important functions of any management, and final decision on selection of an executive should be made by management. Because



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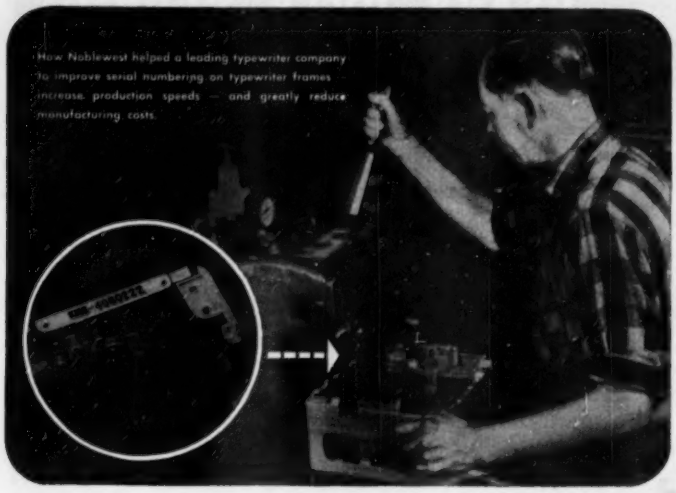
How Noblewest helped a leading typewriter company to improve serial numbering on typewriter frames — increase production speeds — and greatly reduce manufacturing costs.

SERIAL NUMBERING **600% FASTER**

HERE is another example of how Noblewest marking equipment pays big dividends in faster, better marking at greatly reduced manufacturing costs—with resulting savings that often pay for the cost of the equipment within a year or less.

A standard Noblewest general purpose marking machine was tooled for roll marking consecutive serial numbers permanently into die-cast typewriter frames—with a resulting 600% increase in production speed over the method previously used. Features of this Noblewest marking equipment include rocker-style numbering head with newly developed indexing mechanism for automatically advancing serial numbers at each stroke of the machine. The operator needs only to make the initial setting of numbers. Pneumatic table pressure assures positive uniformity of depth of inscription and compensates for slight variations of part thicknesses. For information on how Modern Marking Methods can cut costs in your plant, write the Noble & Westbrook Mfg. Co., 17 Westbrook Street, East Hartford 8, Conn.

(Left) Noblewest general purpose marking machine shown tooled for automatically serial numbering typewriter frames.

(Right) Noblewest precision-built rocker-style automatic numbering head.

management and workers are in many instances the same people at different stages of their careers, immeasurably more emphasis should be placed on selection of key personnel. Many companies are giving meticulous attention to the use of aptitude, intelligence, interest, and psychological tests as a guide in selecting foremen for specific areas of work. These test scores are correlated with the findings of previous school training and work experience.

The quality of supervision can make or break a company. Management should place widened emphasis on the selection and development of new foremen and supervisors. A periodic personnel inventory would be of immeasurable value in making objective selections. Another method would be to permit outstanding employees to substitute in various supervisory capacities for men who are sick or on vacation.

A good supervisory selection system should not only be based on performance data and education of the candidate for the job, but should also consider the viewpoints of the man's fellow workers. It is not believed that an expression from the workers of a particular shop on their views for the selection of a particular candidate for the prospective supervisory job would fall into the category of undue control of shop policies and operation. Management should consider their petition along with all the other information available before final judgment is made on filling the important job. It would be tactless on management's part to make a change of this nature in a shop, affecting the employees, without first preparing them thoroughly by showing it is a wise and necessary move to select a supervisor other than the one

"Our milling machine is acting up awful queer!"

Firth-Sterling's "ON-THE-JOB" ENGINEERING ....increases production 675%

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BETTER FASTER CHEAPER
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On-the-Job Engineering stresses analysis of *your specific* tooling problems. The Firthite tool engineering specialist works closely with the shop superintendent and tool designer and makes detailed studies of *each* tooling problem. The correct solution is made and Firth Sterling furnishes you with the Firthite Tools that will enable you to do the job. . . .

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That record, coupled with comments like: "holds very close tolerances" . . . "versatility, speed and ease of operation" . . . "quick changeability" indicates another thoroughly satisfied Smith & Mills Shaper user.

This noted Indianapolis manufacturer of electro-chemical, electro-mechanical and metallurgical products uses a battery of six Smith & Mills Patented Ram Shapers in their Welding, Contact and Special Metals Divisions. These fine machine tools operate 8 to 10 hours per day, 5 to 6 days per week, 52 weeks per year. The metal being worked is tungsten based alloys containing silver, copper and special copper alloys . . . ranges from 70 Rockwell B to 50 Rockwell C.

Cost-cutting operations like these will pay in your shop too. Get the facts on Smith & Mills superiority and profit-plus features. Available in 10 sizes ranging from 12" to 36", in plain or universal type, in Economy, Standard and Heavy Duty Patterns.

WRITE DEPT. AM-10 FOR FULL DETAILS AND YOUR COPY OF LATEST CATALOG.

SMITH & MILLS SHAPERS, Inc.
DIVISION OF HAMILTON-THOMAS CORP.
HAMILTON, OHIO

desired by the workers. Changes can be upsetting if they are not explained. When the worker knows and sees that management is fair in its selection program, no fear need be entertained that he will resent the selection or lose interest in his work.

The most effective supervisory selection method takes full advantage of the knowledge of the employee's performance obtained during his work history with the organization. Consideration should be given those factors which can be observed in an employee's present work performance that are relevant to performance in supervisory work. An obvious example is the factor of relationships between the employee and his coworkers. What reason is there to believe that an employee who has not maintained good relationships with his fellow workers will do any better in personal relationships after he becomes a supervisor? However, the main element in a good supervisory selection program is the most obvious one; actual performance of work.

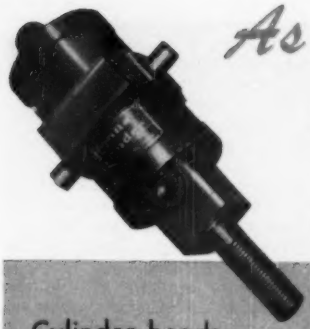
Harry Kaufman
Philadelphia

•

CACHE OR CONFESS?

How can a man's pride be protected and spoilage can be controlled simultaneously? Much depends on the man concerned. If he is a "ham" who frequently spoils work because of sheer inability to do it correctly, a solomon could do little for him—better write him off. If he is reasonable, intelligent and keen, but *careless* in the execution of his work, due, perhaps, to lack of concentration, thinking of things other than the job on hand, it is quite possible to refrain from injuring his feelings and to bring about an improvement in the quality of the work he does. In this case his supervisor's attitude is undoubtedly the key. A good line is to appeal to the man's vanity. "I am *surprised* that a man of your education and ability should have been caught out in a simple job like this. You agree, I suppose, that it is well within your compass? The only explanation I can think of is that your mind was not on the job although *you* were. Put your mind to it in future and the quality of *your* work will be above question."

No foreman should have more to do than he can comfortably cover, given those conditions he should, if he is alert and keen, know who is likely to spoil work and perhaps who is likely to hide it when spoiled. In this connection, Ed's idea of having



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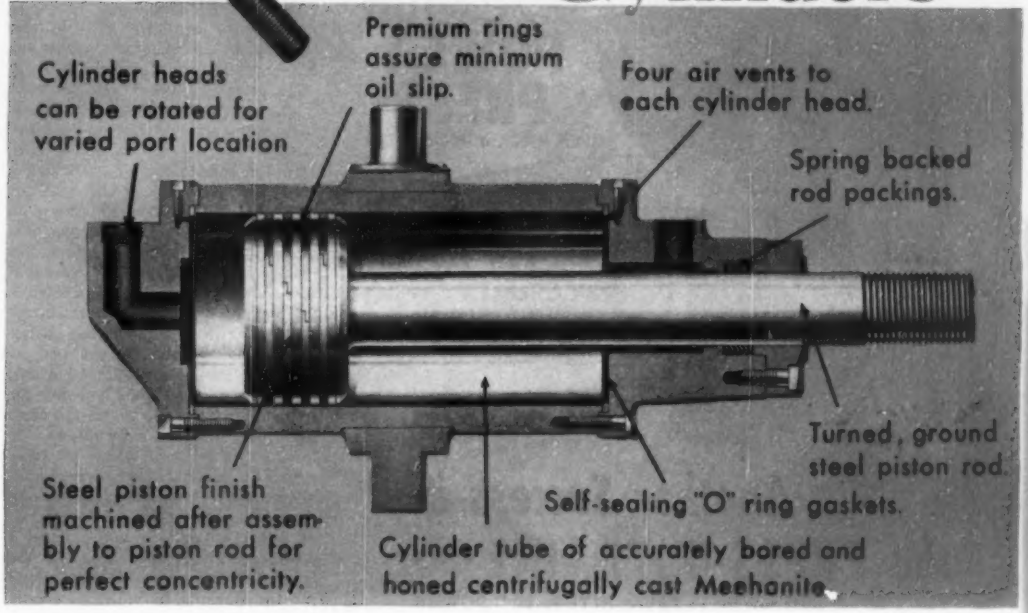
Hanna H P HYDRAULIC Cylinders


Cylinder heads can be rotated for varied port location
Premium rings assure minimum oil slip.
Four air vents to each cylinder head.
Spring backed rod packings.
Turned, ground steel piston rod.
Steel piston finish machined after assembly to piston rod for perfect concentricity.
Self-sealing "O" ring gaskets.
Cylinder tube of accurately bored and honed centrifugally cast Meehanite.

for 50 years the Hanna nameplate has signified the finest engineered products. Meeting JIC Hydraulic Standards is nothing new for Hanna High Pressure Hydraulic Cylinders. They have always been designed, engineered and built to assure top-quality and dependable performance.

There is a complete line of standard Hanna H P Cylinders — for working pressures up to 1500 p.s.i. — to suit nearly every mounting requirement — to supply safe, smooth, economical power in thousands of industrial applications.

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For complete information and specifications on Hanna H P Hydraulic Cylinders, ask for new Catalog 233-A

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HIGHER PRODUCTION

REDUCED MAINTENANCE . . .

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NEW FRAME DESIGN* WITH

BUILT IN TIE RODS

FOR GREATER

STRENGTH

Another Success in the PRESS-RITE LINE • • •

You get higher production from a PRESS-RITE 85 TON POWER PRESS through lower maintenance and fewer breakdowns at higher speeds. The new press has a built-in tie rod* frame that reduces deflection to a minimum and increases the life of your dies. This means less work stoppage and longer life to your press.
Triple ramway lubrication and the cam operated automatic brake reduce wear and speed production by eliminating drag. The anti-friction roller bearings in the flywheel need no adjustment. Its PRESS-RITE 4 plate engagement clutch is faster, more efficient, and can be easily removed for replacement or repair. All PRESS-RITE presses have built-in non-repeat single stroke safety mechanisms for increased safety to the operator.
You get higher production, lower maintenance costs, extra strength, and insured extra tonnage in the 85 TON PRESS-RITE. Do you pay more? NO, SIR! A PRESS-RITE COSTS NO MORE than any ordinary press. See how a PRESS-RITE can increase production for you.

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BOOTH 1720
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SPECIAL NOTE . . .Low overall press height (Approx. 9') permits easy installation in low ceiling buildings. PRESS-RITE POWER PRESSES ARE BUILT IN SIZES FROM 5 TO 85 TONS.

85 TON PRESS available in plain flywheel or back ground models
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Sales Service Machine Tool Co.
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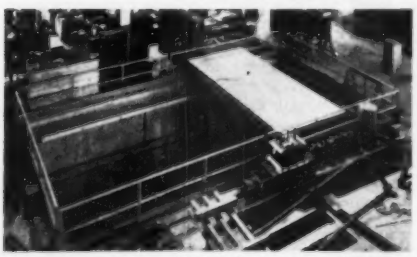
a conference is sound with all men, but why not with the offenders only? In our anxiety not to hurt the feelings of the less satisfactory of the employees we must not make the mistake of offending the entirely satisfactory ones. The competent craftsman who takes a price in his work and rarely spoils a job is not likely to hide a mistake from his foreman, knowing full well that the foreman has little cause for complaint with his record. The knowledge of having "nodded" would sear *his* conscience much more effectively than any displeasure his foreman might see fit to express. To include such in the conference would be like pushing at an open door.

In the case of small work made from, say, bar stock, a check is, admittedly, difficult to apply. But even here a large measure of success will attend properly directed effort. No matter how small the shop, raw material stock should not be accessible to Tom, Dick and Harry. It should be kept in a store under the charge of a reliable stores keeper and issued only on presentation of a chit signed by the foreman or other responsible executive. Short pieces of bar stock should not be allowed to lie about the shops, since they are a direct temptation to the work spoiler and great damage can be done if an odd piece is picked off the floor or bench to replace and conceal a blunder. The composition of the "buckshee" part may be all wrong for the purpose in view, especially where H. P. steam or water installations are concerned.

The way in which the writer tackles this problem is to insist on the shop inspector giving a slip with particulars of all jobs spoiled beyond rectification and a slip for those that can be saved. Those slips are pasted into separate books and since they contain the name of the offender's foreman and the man's check number, keeping tally is easy. Men whose names appear frequently in the black book are shown the number of black marks appearing against their names and are given a helpful talk on how to avoid making mistakes. According to their response they are subsequently graded in the matter of skill, the really poor tradesmen being given the least accurate jobs to do and, of course, the lowest rate. The black book is a most useful means of arriving at a decision as to grading for skill. A record, over a period of time, is much more convincing than merely depending on memory and disposes of any possible argument on the part of the man that he does not spoil all the

ULTRA-MODERN FACILITIES SPEED PRODUCTION, LOWER COSTS ON ELMES PRESSES — LARGE AND SMALL!



Another view of the Elmes "double duty" assembly pit, showing sectional movable covers which permit the simultaneous erection of large and small presses.

This large assembly pit is one of many advanced production facilities available in Elmes' new Cincinnati plant. Men can work on top of large presses at floor level, without climbing up and down. Assembly time is considerably shortened by the ready accessibility of the work. Pit covers are movable, forming a metal floor for simultaneous erection of smaller presses.

Modern facilities such as this, and the extensive working areas of the new Cincinnati plant, enable Elmes to build even a *wider range* of press types and sizes than before . . . at *greater than ever* production economies! Put *your* pressing problems up to Elmes. Nearly a century of applying hydraulics to machinery has earned Elmes Presses a reputation for better, more economical, more profitable performance on every job!

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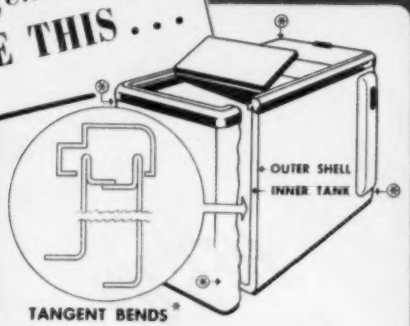

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with labor savings up to 75%

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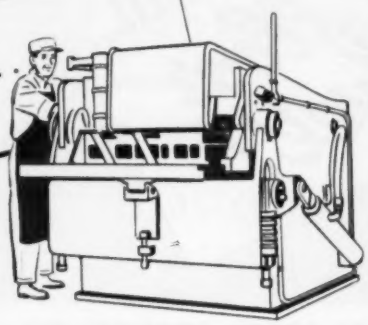


STRUTHERS WELLS

TANGENT BENDERS

in the Production Line

Every plant executive responsible for product design and development—or economies of production, should have the complete technical and illustrative data on Struthers Wells Tangent Benders. May we send you a copy, or would you rather discuss applications with our engineers?

STRUTHERS WELLS
Corporation
MACHINERY DIVISION
TITUSVILLE, PENNA.

Struthers Wells

work which the foreman, relying on memory, sets against him. There is, of course, a limit to the number of men capable of doing only rough work that a shop can carry. When that limit is reached, the least competent must go.

C. D. Mackinnon
Airdrie, Scotland

•

WHOSE BUSINESS?

It is highly probable that most men have little appreciation of the financial problems with which an organization is faced. Many of them never stop to think even of the capital investment, on which a reasonable amount of interest must be returned before anything can be shown as profit. Also, it has been the policy of many labor leaders (who must certainly know something of these things) to keep men in the dark in order that they may selfishly manipulate their feelings in accordance with their own will. It would undoubtedly be well worth while if something could be done to school men in general, at least to the extent that they would know gross receipts must be *far* greater than the cost of raw materials plus payroll, before expenses are covered. Labor has cut its own throat in countless cases where it would not have done so, had it known something of the cost of taxes, insurance, interest charges, and the absolute necessity of a fund for machinery and equipment replacement.

Unless the working man can be brought to a good understanding of these things, it is definitely not wise to tell him about orders on hand or to give him similar information. However, in places and cases where men are of a sufficiently high degree of intelligence to make proper allowance for these things, undoubtedly Al is right in thinking the boss could talk sense to them, and they would appreciate the fact that their job was liable to be sure for some time ahead. Something naturally depends on whether it is known that there are men in the organization who are agitating for a strike, or who would do so if the slightest opportunity presented itself.

We are living in a day when many men have been sold the idea that they are entitled to be paid whether they do much of anything or not. If and when any group of men can be brought fully to understand that every time the selling price of a given product can be reduced without reducing quality, the market inevitably widens for that particular product, it is usually fairly easy for

Press Performance Report

MINSTER

- No. 50-8-84-2532
- 300 ton • 16" stroke
- Double crank, twin drive
- 15 strokes per minute
- 55 x 84 bed size
- Equipped with Minster Air Operated Combination Friction Clutch & Brake.

40,000 Production Hours Total Maintenance $150.

Here are the facts as reported by the [illegible] Corporation, Jamestown, N. Y.:

In ten years of operation of our Minster #50-8-84 press, the following impressive production and maintenance figures have been compiled.

The press has run approximately 40,000 production hours and has produced upwards of 800,000 pieces.

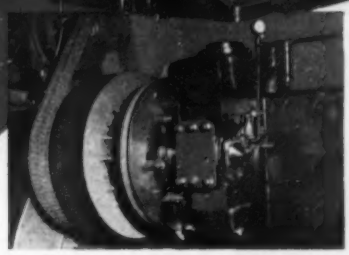
We are using the machine for blanking, drawing and forming operations, all as single stroke work.

Repair costs for parts and labor for the ten-year period total about $150.00, and the total down time has been about 40 hours.

Our experience with this machine has been exceedingly favorable. It is very well constructed and can perform very heavy work for long periods of time.

We are very well pleased with this machine in all respects, and since installing it we have purchased, and are using continuously, four other types of Minster presses.

It is an inescapable conclusion . . . Minster presses and Minster clutches have made an impressive record for design excellence. Minsters are now producing results considered impossible only a few short years ago. Higher speeds . . . lower maintenance . . . greater accuracy . . . longer die life . . . unusual versatility . . . *you get all your requirements with a Minster press.*



The Minster combination friction clutch and brake on #50-8-84-2532. Records show only $48 was spent on repair parts for this unit . . . 12 segments of brake friction rings. Total repair costs for the entire 10-year period, including labor, was approximately $150.

MINSTER
FIRST IN *Press* DESIGN

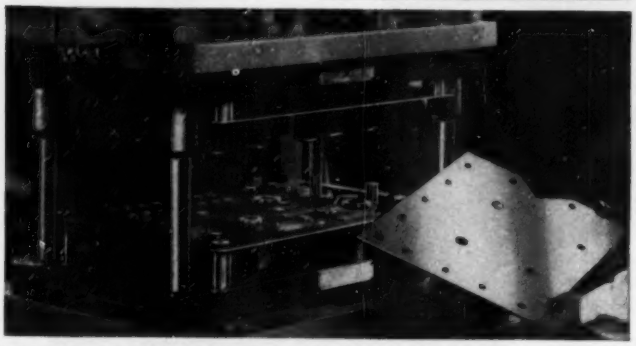
THE MINSTER MACHINE CO., MINSTER, OHIO

New • Fast • Proven

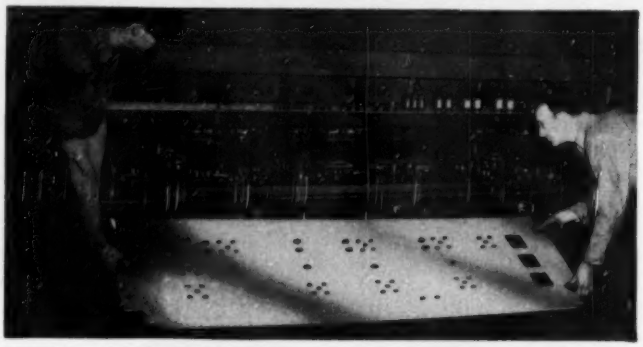
LOW COST methods for PERFORATING and NOTCHING SHEET METALS

Both methods feature: LOW DIE COSTS

All units and parts are interchangeable and used repeatedly in different arrangements. **INCREASE PRESS PRODUCTION**—Down time is minutes as compared to hours for changeover. For precision work in all types and sizes of presses. **START PRODUCTION *at once.*** Pierce up to ¼" thick mild steel. Saving money in the best known plants.



Whistler *MAGNETIC* Dies at work in large inclinable press. Magnetized units hold the retainers. No bolting required. A fast, economical method in making up a punch and die set for short or long runs. All parts re-usable.



Whistler *ADJUSTABLE* Dies on ⅛" steel perforating and notching job, using Tee slotted die set. With Whistler Adjustable Punch and Die units production starts within hours instead of weeks. Last minute job changes made quickly.

Here are the complete details with prices and application illustrations. Send for these catalogs. No obligation.

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Adjustable, Magnetic, Custom and Cam Dies for all Industry

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them to appreciate the parallel fact that ability to lower the selling price also broadens the base of their job security. But when men do not understand this, Ed has the right of the argument; it would certainly be bad business to give them access to one side of the facts when they do not have them all.

Again, if men could really be made to understand there are times when the market loosens and times when it tightens, and could be kept fully informed of the facts in this respect, they would be willing in most cases to welcome a *temporary* increase in lush times, with a following temporary and voluntary decrease when lean times followed. Where they cannot be made to understand, there is nothing for it but for the company to hold onto the surplus from lush times to compensate for the deficit in lean times.

Today industrial organizations need men in their personnel department who are more than ever able to make a close study relative to employee education and employee reactions. It is certainly a sad situation when any group of men, smarting under an *imaginary* grievance, do their best to obtain what they sincerely believe is only an equitable adjustment, but end by tying the hands of their employer, market-wise and consequently hurt themselves.

One bright spot in the situation is that more and more men are coming to know that many so-called victories are *very* hollow ones. The "victory" obtained for his miners by John L. Lewis this year, for instance, is known by all except the most ignorant men to have taken money from the pockets of the miners, to have reduced the market for coal (and therefore for their services) still farther, and indirectly to have reflected badly on organized labor in general. The day may yet come when it will be possible to get past the soap-box orator, and get some of the true and salient economic facts to the minds of working men in general.

John E. Hyler
Peoria, Ill.

•

SHOT IN THE ARM

THE MODERN day foreman does not try to force his will upon others. He does not try to drive the employee by throwing his weight around. If he is a good leader he prefers to get the job done and make the employee want to do it. We all want to do a good job. As a matter of fact we all want the same things in life. Every-

this v-belt inventory is unnecessary

Standardize on Veelos—the adjustable v-belt—and *eliminate* the storage problem, the control problem and the "tied-up" money problem that is usual in maintaining a full stock of endless v-belts.

this stock of VEELOS replaces up to 316 sizes of endless v-belts

Four reels of Veelos can take care of *every* v-belt need in the O, A, B and C widths. V-belt control is simplified, only a minimum storage space is needed and inventory-dollars are kept at rock bottom.

this VEELOS v-belt drive steps up production

Veelos supplies vibrationless, full power delivery and can be simply and easily adjusted to maintain uniform tension on all belts. Veelos can be installed quickly . . . even without dismantling outboard bearings.

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V-BELT

ADJUSTABLE TO ANY LENGTH • ADAPTABLE TO ANY DRIVE

Made in all widths in three types: regular, oil-proof, static conducting. Also double V in A and B. Packaged on reels in 100-foot lengths. Sales engineers in principal cities; over 350 distributors throughout the country. VEELOS is known as VEELINK outside the United States.

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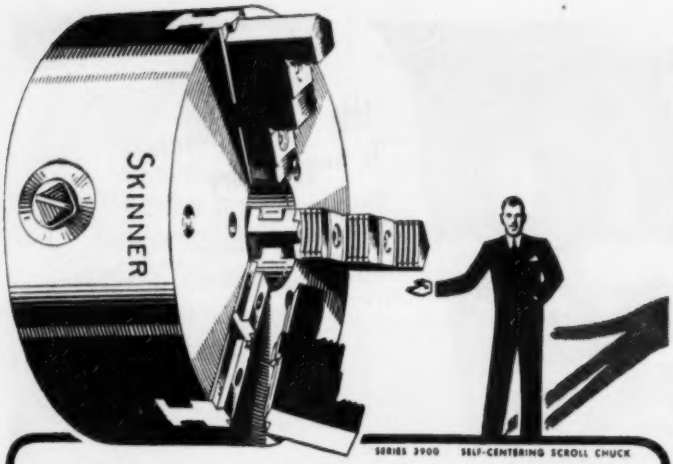

SERIES 3900 SELF-CENTERING SCROLL CHUCK

SKINNER 3-JAW SCROLL Chucks

LARGE in VALUE..

LONG in LIFE...

BIG in QUALITY...

LARGE IN VALUE... because Skinner 3-Jaw Self-Centering Scroll Chucks are made with the most modern machines and by the most modern methods—there is more for your money in Skinner Chucks because accuracy is built in to last.

LONG IN LIFE... because every moving part is made of alloy steel, properly heat-treated, then ground to gage—and every moving part is grease lubricated from a single Alemite fitting. Interchangeability is a "must" in every Skinner Chuck.

BIG IN QUALITY... because, for 61 years, Skinner has provided chucks to meet the latest machine tool requirements. Skinner quality starts with modern design and makes itself evident in every step of construction. There are no better chucks made.

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THE SKINNER CHUCK COMPANY

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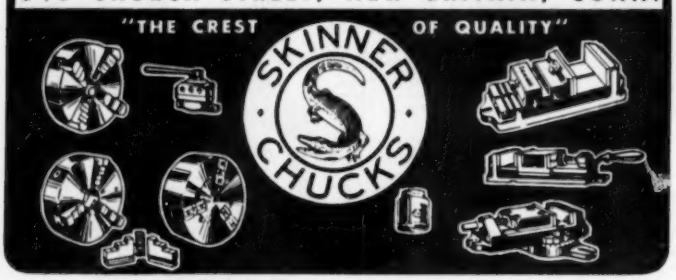

HAND & POWER OPERATED MACHINE CHUCKS—AIR CHUCK EQUIPMENT
—FACE PLATE JAWS—MACHINE VISES

one wants health, food, sleep, money and the things money will buy. We all want the well-being of our family. All of these things are gratified except one other thing.

The craving to be appreciated. We all want and like that feeling of importance. Any fool can needle the employee, or threaten him with the loss of his job. These methods may produce a temporary shot in the arm but they have sharply undesirable results.

No person likes to be told that he is wrong and nobody likes a direct order. Encouragement, understanding, praise of some good quality will get lasting results in both production and quality. There is no one thing that can achieve this result successfully except a desire on the foreman's part to be thoughtful of the other fellow's feelings, his ideas, and combine them so that both feel they can obtain the things they both want. The friendly approach, the friendly challenge and the power of suggestion will go a long way to get the necessary cooperation.

Every company employee has some good quality. If we praise the good qualities before finding fault we will make the faults easy to cure. Every man works better under the spirit of approval. Show honest appreciation and give the worker a good reputation to live up to, he will seldom let you down. You don't have to overdo it, but if you occasionally recognize some good quality in the employee he is also your friend—and production benefits as a result.

A. E. Salmons
Philadelphia

NEW BOOKS

FUNDAMENTALS IN THE PRODUCTION AND DESIGN OF CASTINGS — *By Clarence T. Marek, Associate Professor of Manufacturing Processes, Purdue University. Published by John Wiley and Sons, Inc., 440 4th Ave., New York 16, N. Y. 383 pages, Price $4.*

Casting design and casting practice techniques are seldom made available to any degree of utility, in book form. Here is one of those rare contributions to this vastly important field of metalworking. Written for the design engineer directly concerned with engineering parts, this book stresses a twofold responsibility: Design, to perform a given function, of a part that may be pro-

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Weigh less than ONE-HALF the weight of class 2 or class 3 copper alloy

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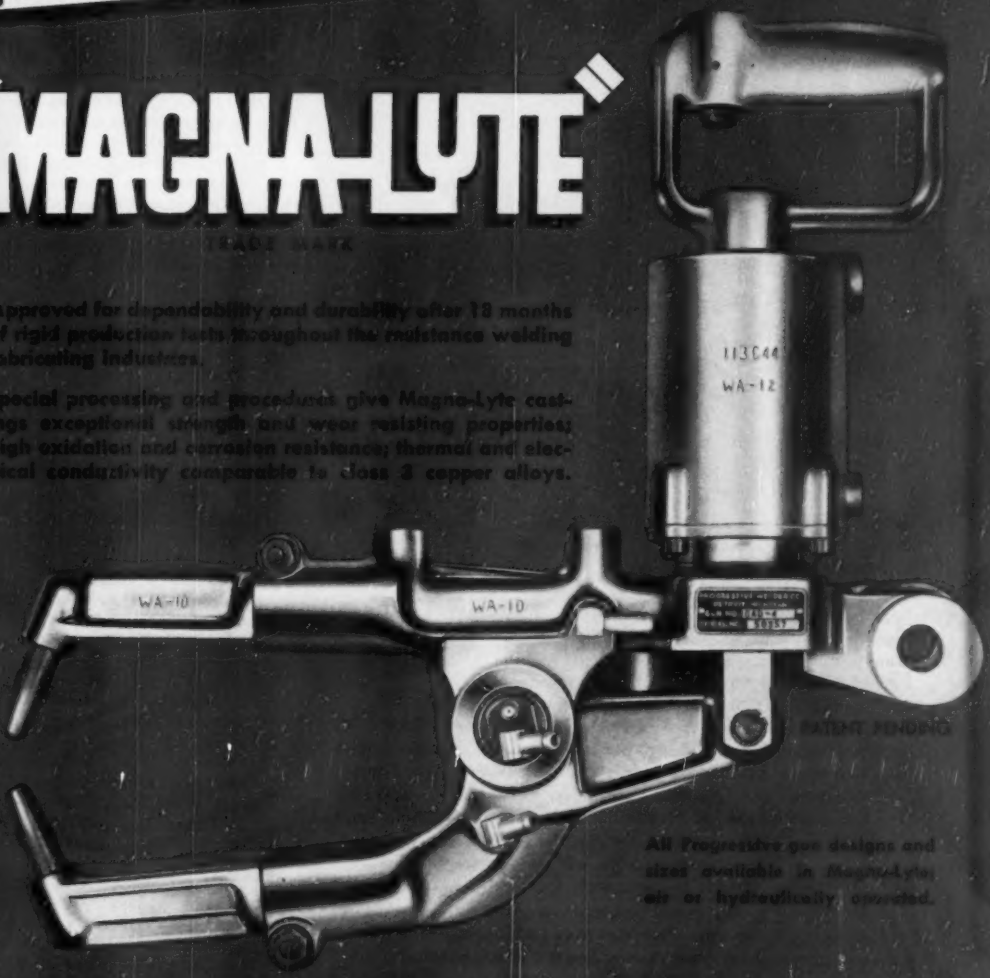
Approved for dependability and durability after 18 months of rigid production tests throughout the resistance welding fabricating industries.

Special processing and procedures give Magna-Lyte castings exceptional strength and wear resisting properties; high oxidation and corrosion resistance; thermal and electrical conductivity comparable to class 2 copper alloys.



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All Progressive gun designs and sizes available in Magna-Lyte; air or hydraulically operated.

Ask your Progressive representative to show you a Magna-Lyte gun. Write for Pictorial No. 5006 "Magna-Lyte Makes Heavy Work Light."

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PROGRESSIVE *Welder Sales Company*

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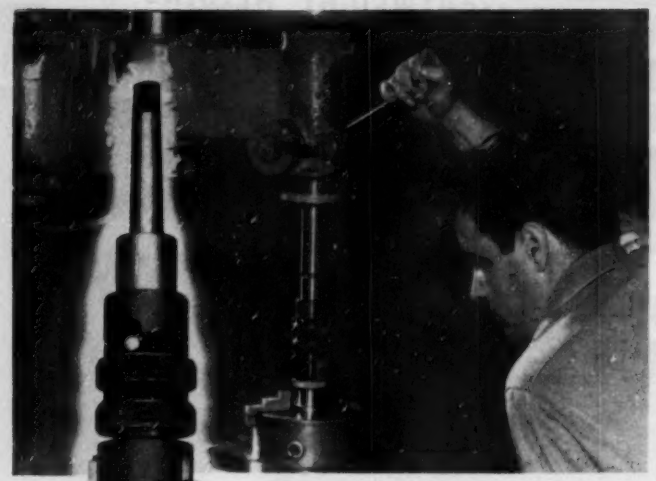
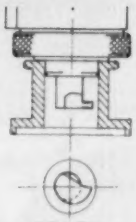
DETROIT 34, MICHIGAN



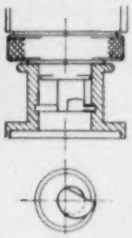
One RECESSING TOOL...
Any RECESSING JOB!

● Cut Recessing Costs on your Drill Press . . . Boring Mill . . . Turret Lathe . . . Radial Drill . . . etc. The **ALL NEW** Series "R" Maxwell Recessing Tools provide unlimited versatility.

SIX sizes are stocked for immediate shipment. Shanks to fit your machines are instantly interchangeable. Capable of taking cuts at extremely high rates of feed, the new Maxwell tools feature a micro-adjusting collar which facilitates rapid and accurate recess diameter control to within 0.001-inch or 0.050-inch per tool revolution. Cutters can be supplied to make single or multiple recessing in a single operation.



Cut location can be made from either top or bottom surfaces. The ball-bearing pilot facilitates use of Series "R" Recessing Tools with existing fixtures. If fixtures are not used, ball-bearing pilot will stop on the workpiece surface to accurately locate the cutter.



Hardened tool-steel wearing surfaces guarantee maximum tool life. Cutting action is smooth and requires only finger-tip feed pressure. Series "R" Recessing tools are regularly furnished having cutter ratio of either 1:3 or 1:1. Hole in tool block permits flow of coolant or lubricant to cutter.

Standard Series "R" Recessing Tools are available to cut recesses from ¼ to 4¼ inches in diameter. Write today for catalog "R" . . . .

Precision boring with MASTUR heads is described in catalog PBH. These inexpensive tools feature large capacity, adjustability and accuracy. Specifications are charted.

Production Boring with the E-Z set line of Boring heads is subject of catalog No. 30. Complete line of tools is shown. Prices, capacities and specifications are charted for reference.

THE MAXWELL COMPANY

300 BROADWAY BEDFORD, OHIO

duced with the least expenditure of labor and material.

Included in the book are these important phases; an over-all view of the casting industry, descriptions of basic molding processes, the theory of clay bond, high-voltage X-ray and supersonic inspection, modern theories on the melting of cast metals, and a description of present-day production methods. A the end of each chapter a series of questions highlight the important points. The method of presentation suggests value as a text for students of mechanical or metallurgical engineering. Many illustrations from modern industrial practice, plus an extensive bibliography, appendix, and index, round out this practical contribution to metal casting efficiency.

•

MACHINING—THEORY & PRACTICE. *Series of 13 educational lectures on machining. Published by American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio. 504 pages. Price $6.50.*

The 15 authors of this series of lectures presented at the 31st National Metal Congress are primarily metallurgists, each a leading specialist in the field of which he writes. Throughout the book there is strong emphasis on the metallurgical aspects of machining. Because of the increasing importance of these aspects as we go to higher speeds, many of the chapters should prove of considerable interest to those concerned with the practical problems of machining.

A keynote by Hans Ernst emphasizes three aspects of machining of economic importance: productivity, quality, and tool life. M. E. Merchant summarizes some of the basic metal cutting research.

Milton C. Shaw covers the theory, applications, and limitations of cutting fluids. Francis W. Boulger discusses the machinability of various materials and touches on the possibilities of high-speed machining.

Of special interest is the chapter by Michael Field and Norman Zlatin on the relation of microstructure to machining characteristics.

These are only a few of the chapters, but are typical of the coverage of the book. Though some of it may go too deeply into the theory to suit the practical man, that theory is important and from it grows the practical data presented.

This volume is strongly recommended to anyone interested in a more thorough understanding of the theory and practice of machining.

The NEW MOTCH & MERRYWEATHER No. 00-G Circular Sawing Machine

No. 00-G automatic model has air-operated stock feed for standard lengths up to 24".

Insert jaws of desired angle permit precision cut-off of stock up to 45° angle.

NOW, for the first time on a circular sawing machine, you can do square and angular cutting up to 45° of ferrous or non-ferrous stock up to 3" round or square, *fast and accurately.* The rugged one-piece saw head is gravity fed; speed changes by pick-off gears. Automatic stock feed for high production; manual feed for smaller shops and tool rooms. Special fixtures for odd-shaped parts. *Let us figure how much we can save you* on that next difficult job.

Write today for Bulletin 00-G.

Manufactured by

THE MOTCH & MERRYWEATHER MACHINERY COMPANY
715 PENTON BUILDING • CLEVELAND 13, OHIO
Builders of Circular Sawing Equipment, Production Milling, Automatic and Special Machines

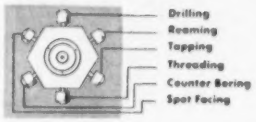
PRODUCTION-WITH-ACCURACY MACHINES AND EQUIPMENT

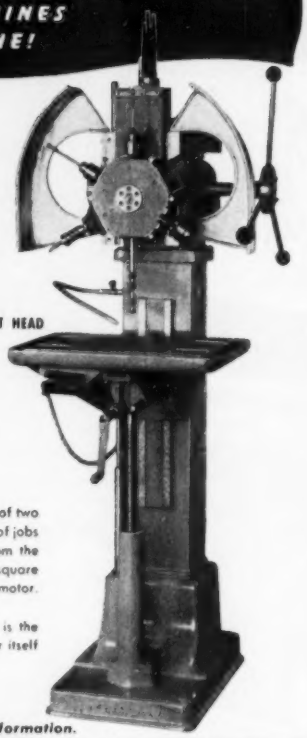
THE Burgmaster SIX SPINDLE TURRET TYPE AUTOMATIC INDEXING DRILLING and TAPPING MACHINE

GIVES YOU 6 MACHINES IN ONE!

Burgmaster A Universal Type Production Machine, features .....

* 8" STROKE
* PRE-SELECTIVE SPINDLE SPEEDS (choice of 6 per set up)
* INDIVIDUAL PRECISION DEPTH STOPS
* 110 VOLT CONTROLS
* 2-SPEED MOTOR
* ADJUSTABLE FEED HANDLE
* 9¼" THROAT CLEARANCE
* 15" x 21" TABLE WORK SURFACE WITH T SLOTS
* SPINDLES SHIELDED DURING INDEXING OF TURRET HEAD
* ONLY SPINDLE IN OPERATION TURNS





The Burgmaster enables one operator to do the work of two or three and get the job done faster, better. A variety of jobs can be handled without moving the work piece from the machine table. It is simple to set up, requires but 6 square feet of floor space and is powered by a single motor.

Burgmaster users will tell you that their Burgmaster is the most economical machine in their shop, and pays for itself in a short period.

Write today for detailed information.

BURG TOOL MANUFACTURING CO.
3743 DURANGO AVE., DEPT. AM-1 LOS ANGELES 34, CALIF.

HERE'S Tool-flex
NEOPRENE MOUNTED FLOATING TOOL HOLDERS
Another Outstanding Product of
BURG TOOL MANUFACTURING CO.

SELF-CENTERING
(ELIMINATES COSTLY SET-UP)
FULL-FLOATING • POSITIVE DRIVE
OIL-RESISTANT NEOPRENE MOUNTING
REDUCES TOOL BREAKAGE
SIMPLE CONSTRUCTION
(ONLY FOUR MAIN PARTS)

Write for information ... Dealer inquiries invited

BURG TOOL MANUFACTURING CO. Dept. AM-1
3743 DURANGO AVE. • LOS ANGELES 34, CALIF.

Names in the News

Theodore G. Hughes has been named general manager of all manufacturing operations for Daystrom Corp. plants at Olean and Friendship, N. Y.

A. E. Campbell has been appointed sales manager of Clapp Instrument Co., Webster, Mass.

Harold W. Lorenson has been named head of a new Cleveland office of Superior Electric Co., Bristol, Conn.

H. G. English has joined the engineering staff of Ford Motor Co., Dearborn, Mich., as a research assistant working on automatic transmission. **V. J. Jandasek,** who has been assistant to Mr. English at Borg-Warner Corp., has joined Ford in a similar capacity. Both engineers have been active in developing the firm's new torque-converter type automatic transmission.

Glenn R. Kraus and **Ernest C. Hawkins** have joined the sales staff of Rees Machinery Co., Pittsburgh.

Roland W. Burt has been appointed Chicago sales manager for Joseph T. Ryerson & Son, Inc., steel distributors. **Allen P. Beckloff** has been named manager of the Tubular Products Div.

Henry W. Luetkemeyer, chief engineer of Cleveland Graphite Bronze Co., has been elected vice president, engineering. **Merrill A. Young** was elected vice president, personnel, and **Robert H. Daisley,** vice president and director of manufacturing at Eaton Mfg. Co., was elected a director.

George F. Wilhelmy, formerly assistant sales manager, Railway Div., National Malleable & Steel Co., Cleveland, has been named sales manager of that division, with **Donald F. Kittredge** assistant sales manager. **Robert D. Sowers** has been made sales manager of the Chicago Railway Div. **George R. Farrell** and **Frank E. Moffett,** have retired.

James L. Snaman has been appointed general sales manager, Pannier Corp., Pittsburgh.

Courtland F. Carrier has been named technical adviser of the Fabricating Div., Western Brass Mills, (East Alton, Ill.) a division of Olin Industries, Inc. He will assist customers' usage of stamped and drawn parts produced from copper-base alloys.

J. E. Weldy has been named marketing manager, **J. S. Gillespie** product sales manager, and **J. M. Bertotti,** field sales manager of Carboloy Co., Inc., Detroit.

M. W. Heinritz, formerly vice president of Gould Storage Battery Corp., was elected vice president in charge of industrial sales of Gould-National Batteries, Inc.

Dwight E. Moorhead has been named manager of the San Jose (Calif.) Motor Divisions of General Electric's Small & Medium Motor Divisions. Earlier this year he was appointed administrative assistant to the manager of the divisions. **O. F. Vea** has been named manager of sales and **F. B. Hornby,** manager of engineering, in the Small & Medium Motor Divisions. Other Apparatus Dept. appointments: **Paul R. Hartig,** formerly assistant superintendent, Holyoke (Mass.) factory, has been named manager of the Oakland (Calif.) transformer plant. **Edward A. Green** has been named staff assistant to **A. W. Bartling,** general sales manager of Small Apparatus Divisions. He will be replaced in his former position as manager of sales of the company's Control Divisions by **L. Dean Fowler**, formerly manager, San Jose (Calif.) Motor Sales Div. **A. K. Bushman** has been named manager Industry Divisions, in the Apparatus Dept. sales organization.

E. B. Whittemore has been appointed manager of the Specialty Steel Spring Dept. of Cold Metal Products Co., Youngstown, Ohio.

Charles R. Robison has been appointed general sales manager representing Dayton Rogers Mfg. Co., Minneapolis, in the Baltimore area.

R. H. Olson, formerly vice president in charge of sales, has been named president of Electric Machinery Mfg. Co., Minneapolis, a subsidiary of Worthington Pump & Machinery Corp. He succeeds **W. H. Feldman**, who has joined Worthington as vice president in charge of sales. **A. P. Burris** succeeds Mr. Olson as sales vice president. **P. L. Shawley** has been appointed New York district sales manager.

Send for Nicholson Bulletins on These

4 WAYS TO SAVE TIME

in Production and Maintenance

On the basis of their time-saving records, leading shops are increasingly standardizing on these 4 Nicholson units. For details, send for the individual bulletins listed here.

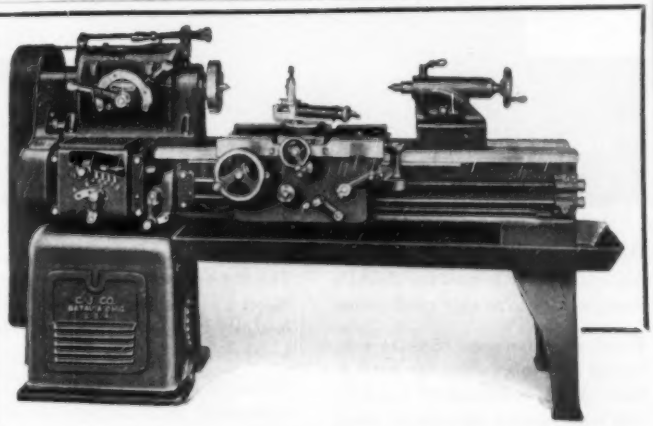
NICHOLSON EXPANDING MANDRELS—Set of 14 does work of 209 solid arbors; sensational time savers in some operations. Sold singly or in sets; for bores ½" to 7". Bulletin 1043.

NICHOLSON ARBOR PRESSES—A ready, precision tool for bending, pressing, assembling, broaching, etc. 5 sizes: for 5¾" to 20" diam.; light to 5-ton capacity. Bulletin 845.

NICHOLSON AIR TRAPS—For intercoolers, aftercoolers, receivers, tanks, etc. Non-wire drawing valve opens and closes instantaneously. This feature with extra large drainage capacity effects fast, positive action. 3 types for pressures to 1500 lbs. Catalog 250.

NICHOLSON CYLINDER CONTROL VALVES—Specially treated hard seats, choice of metals for specific mediums, and easy repacking cut maintenance time. 2, 3, 4-way and special types. All manner of operation. Size ¼" to 2½"; pressure to 5000 lbs. Catalog 546.

W. H. NICHOLSON & CO., 114 Oregon St., Wilkes-Barre, Pa.

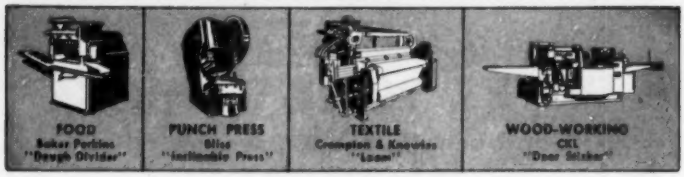


C. & J. Geared Head LATHE 16 INCH 12 SPEED

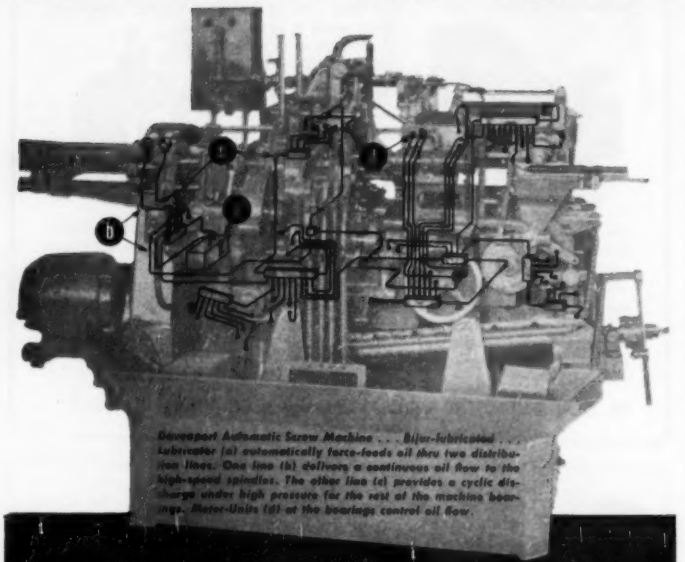
Designed for high quality general service. Built in one size and one model only. Powerful, accurate, tooled and equipped to produce efficiently. Features exceptionally long carriage bearing (23⅜"). Feed is provided by separate rod, so lead screw is used only for thread chasing. Complete regular equipment includes thread indicator. Guaranteed accurate within .001 inch in 14 inches. *Write for new descriptive bulletin 38-A-8.*

CARROLL & JAMIESON MACHINE TOOL CO.
BATAVIA, OHIO

LEADING MANUFACTURERS BUILD IN THE BIJUR SYSTEM



automatic lubrication



Davenport Automatic Screw Machine . . . Bijur-lubricated . . . Lubricator (a) automatically force-feeds oil thru two distribution lines. One line (b) delivers a continuous oil flow to the high-speed spindles. The other line (c) provides a cyclic discharge under high pressure for the rest of the machine bearings. Meter-Units (d) at the bearings control oil flow.

boosts production and cuts maintenance

Designing an automatic lubricating system into a machine doubles your prospects for user satisfaction.

First, maintenance time is converted into more time for production. A Bijur-lubricated machine oils itself during operation, doing away with wasteful down-time for lubrication.

Next, maintenance costs are cut as effective bearing life is lengthened. The Bijur system provides positive Meter-Unit control of oil flow *at the bearings*, considerably reducing bearing wear.

When you design that new machine, call on the Bijur engineer. Meanwhile, for further information write for "The Travels of Modern Lubrication."

389

BIJUR
LUBRICATING CORPORATION

LONG ISLAND CITY 1, NEW YORK

Edmund A. Watson has been named general improvement engineer, American Car & Foundry Co., succeeding **John W. Sheffer,** retired. **John C. Coonley** has been appointed manager of the firm's Valve Div. **Ralph F. Koeneman** has been appointed chief of passenger car engineering at ACF's plant in Berwick, Pa.

Fred A. Kaufman has been appointed general sales manager, McKay Co., Pittsburgh. **E. H. McGraw,** has been named eastern district sales manager.

Emil P. Knapp, formerly assistant chief engineer at the Square D Co.'s Kollsman Instrument Div., Elmhurst, N. Y., has been named chief product engineer.

Paul H. Davey, Jr. has been elected vice president in charge of production, Davey Compressor Co., Kent, Ohio. He has been plant production manager for the past two years.

Floyd Monteith, formerly a service engineer, has been appointed a Chicago representative of Kennametal Inc., Latrobe, Pa. **Robert Karakoosh,** also a former service engineer, has been named a Springfield, Mass., representative, and **William Collins** and **Harold D. Killmer** will work there as service engineers. **Conrad Seim** has been appointed service engineer working out of Los Angeles.

Harry L. Jenter, general superintendent of Cuyahoga Works, has been appointed chief engineer for American Steel Wire Co., Cleveland, succeeding **Robert E. Cramer,** who was appointed to the newly-created post of chief engineer for the firm's Cyclone Fence Div.

Raymond W. Ayers has been elected vice president of Frederick Hart & Co., Inc., Poughkeepsie, N. Y., a subsidiary of ATF Inc.

Alan J. Bronold has been appointed sales manager for Sterling Electric Motors, Inc., Los Angeles.

John R. Harbaugh has been appointed assistant general manager of sales, Jessop Steel Co., Washington, Pa. **Eugene N. Lohre** has been named Chicago district manager and **Homer A. Mawhinney** southern district manager.

Benjamin Sampson has been named general sales manager, K. H. Huppert Co., Chicago.

Owen C. Stevens heads a new Connecticut agency for the Kingsbury Machine Tool Corp., Monarch Machine Tool Co. and Minster Machine Co. The office is located in West Hartford at 62 LaSalle Road. He is a former Stedfast & Roulston representative, working out of Springfield, Mass.

H. B. Scott, previously with Calorizing Corp. as metallurgical engineer, has joined Michiana Products Corp., Michigan City, Ind., to be in charge of southern Indiana sales area, based in Indianapolis. The Philadelphia area has been assigned to **L. S. Johnson,** formerly superintendent, Midvale Corp. **A. J. Popovich,** formerly metallurgical engineer with Allis-Chalmers Mfg. Co., is now in charge of northern Indiana with headquarters at the plant.

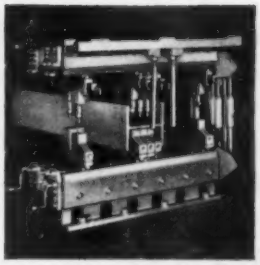
Keith J. Brownell has been appointed sales manager, Bearing Div., McGill Mfg. Co., Inc., Valparaiso, Ind.

Fred W. Fisher has been named head of the Stamping Div., Swift Mfg. Co., Detroit. **Joseph Rumpf** has been appointed head of the Swift Machine Div., and **W. W. Pound** is the new Ohio representative for the firm.

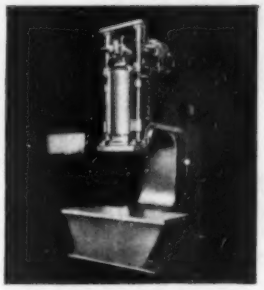
Houston E. Landis, Jr. has been elected vice president of Electrol, Inc., Kingston, N. Y. He has been associated with Air Reduction Sales Co.

Arlo Israelson has been named chief engineer for Eriez Mfg. Co., Erie, Pa. Mr. Israelson replaces **W. W. Mojden,** now with Mills-Winfield Co., Eriez sales office in Chicago.

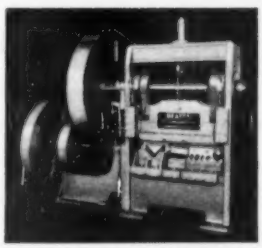
W. F. Lisman, former president of Leland Electric Co., has been named vice president in charge of sales for Brown-Brockmeyer Co., Dayton, Ohio, manufacturers of electric motors and grinders. Six new district managers have also been appointed: **F. E. Schumacher,** Chicago; **A. M. Hill,** St. Louis, covering eastern Missouri, southern Illinois, and Arkansas; **F. B. Larsen,** Philadelphia, handling eastern Pennsylvania, Maryland, and Delaware; **E. A. Linhart,** Pittsburgh, in charge of eastern Pennsylvania; **Louis Ellinger,** New Haven, covering Connecticut; and **Ralph Cockroft,** Los Angeles, covering California. The Jack Gilbert Co., formerly handling Missouri and Kansas, will now represent the Leland line in western Missouri, Kansas, Oklahoma, and Nebraska.



BEATTY Adjustable Tools punch webs of beams and channels, legs of angles and plates.



BEATTY 250-Ton Gap Type Press for forming, bending, flanging, pressing.



BEATTY Guillotine Bar Shear for "short order" shearing without changing tools.

BEATTY Horizontal Hydraulic Bulldozer for heavy forming, flanging, bending.

WHICH MACHINE MIGHT SOLVE YOUR PROBLEM

BEATTY machines are tailor-made to solve certain production problems — to do a job better, faster, at less cost. And this long and varied experience qualifies our engineers to grasp your problem quickly and to provide a practical, proven solution.

There is a better way to handle most production problems, and our engineers are dedicated to finding that better way. If you have a problem, write us. We have the answer.

HYDRAULIC HEAVY METAL WORKING EQUIPMENT

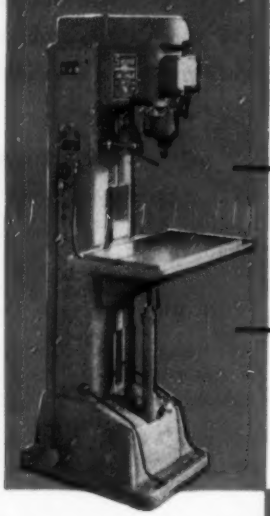
BEATTY MACHINE AND MFG. COMPANY
HAMMOND, INDIANA

Never Before

SO MANY ADVANTAGES for HIGHEST PRODUCTION

4800 PER HOUR!
3800 PER HOUR!
2500 PER HOUR!

For Top Production

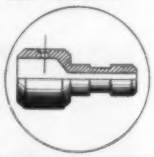


SNOW

FULL UNIVERSAL MACHINES

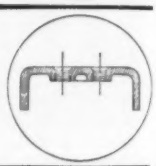
Air operated, electrically controlled Snow tools are establishing amazing production records daily on a wide variety of work. Just note these typical examples:

DRILLING



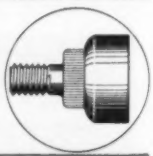
Crossdrill end C "T" Sink 1/16" Hole
Material—Brass
Production—4800 per hour
Fixture—#15 Vertical index
Equipment—#1-UD Drilling Machine

TAPPING



Tap Two #10-32 Holes
Material—Steel stamping
Production—3800 tapped holes per hour
Fixture—#14 horizontal index
Equipment—#1-UT tapping machine

THREADING



3/8"—24 Thread—1/2" Long
Material—Die Cast Aluminum
Production—2500 per hour
Fixture—#10 Drum dial
Equipment—#3-TR Threading machine

Snow air operated—electrically controlled machines have built in full universal controls that allow selection of the type of spindle cycle desired. This feature also permits instant synchronization of the standard Snow Master Fixtures. All types of air operated automatic and semi-automatic jigs and fixtures are carried in stock. Standardization permits low cost tooling—and—high production.

Sensitivity of power application prevents tool breakage.

Simplicity of control means that set up and operation can be handled by a less experienced operator with minimum fatigue.

SNOW

MANUFACTURING COMPANY
435 Eastern Ave., Bellwood, Illinois
(Chicago Suburb)

Single Spindle Verticals • Two-Spindle Verticals • Two-Spindle Horizontals • Automatic Nut Tapping Machines • Drill Press Tap Heads • Automatic & Semi-Automatic Jigs & Fixtures

Submit Sample Parts for Production & Cost Estimates

Rear Admiral Walter G. Schindler, chief of research for Naval Bureau of Ordnance, has been named commander of the Naval Ordnance Laboratory, White Oak, Md., succeeding **Rear Admiral B. Hall Hanlon,** who has been given charge of the Naval Gun Factory in Washington, D. C.

Frank T. Wruk has been elected vice president in charge of sales and service, Peerless Machine Co., Racine, Wis. He joined the company in 1920, and since then has served in the research dept., as assistant works manager, and more recently in sales engineering and service.

O. L. Pringle, vice president and director of Columbia Steel Co., San Francisco, a U.S. Steel subsidiary, has been named special assistant to the president. **Marcus J. Aurelius,** vice president of U.S. Steel Supply Co., Chicago, succeeds Mr. Pringle as sales vice president.

K. A. Vaughan, manager of field engineering, has been named manager of sales engineering, Gould Storage Battery Corp., Trenton, N. J. He joined Gould in 1928, in 1945 was named field engineering manager.

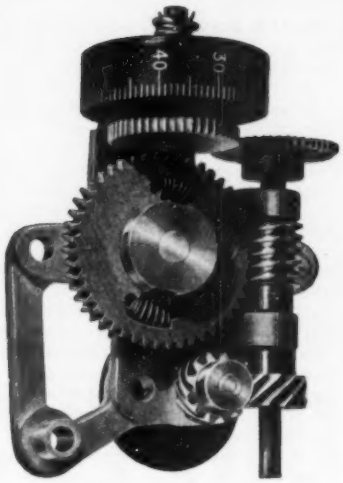
Thomas Sproule, production manager of the Fitchburg Works of General Electric's Welding Div., has been named assistant manager of manufacturing for the Fitchburg Turbine & Welding Divisions. **C. C. Clymer** has been named manager, Materials Handling & Testing Equipment Div. of GE's Industrial Engineering Divisions, replacing **M. A. deFerranti,** named assistant to **A. W. Jacobsen,** manager, Parts Div. Aircraft Gas Turbine Divisions.

H. R. Gibbons has been named chief engineer for the Hyatt Bearings Division of General Motors Corp., Harrison, N. J. He succeeds **O. W. Young,** who assumes new duties as technical assistant to the office of the general manager.

R. T. Adams, formerly Chicago sales representative for Lima-Hamilton Corp., New York, has been appointed sales manager for can-making machinery. Mr. Adams succeeds **Roland H. Johnson,** who has joined the Standard Knapp Division of Hartford Empire Co., Hartford, Conn.

Henry J. Eberhardt continues as vice president in charge of engineering of the newly reorganized Newark Gear, Inc., Newark, N. J.

GEARS
of all types



QUAKER CITY GEAR WORKS

1910 N. Front St. Philadelphia 22, Pa.

No More Guessing

. . . accurate *Torque Control*

No Friction Adjustments Moving Parts Fragile Mechanisms

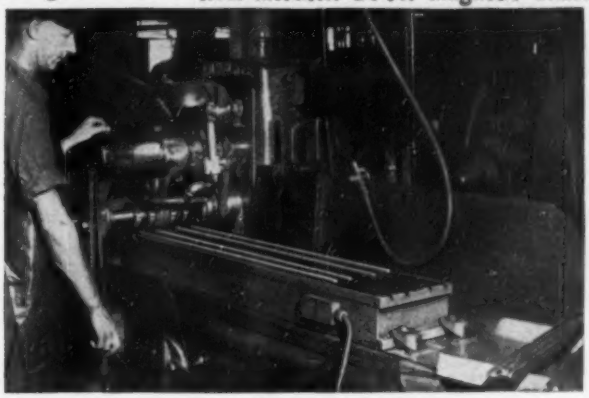
More Accuracy — Permanently Accurate — Closer Product Quality Control Tool Life—Lower Tool Cost Speed — Lower Assembly Cost Per Unit

Guessing How tight threaded fasteners are.

Use a Sturtevant permanently accurate torque wrench to obtain product quality control and thus insure field performance and product reputation. Write for Bulletin—S-WS.

PA STURTEVANT CO
ADDISON QUALITY ILLINOIS

Tripled PRODUCTION . . .
That's What Remington Rand Did With MAGNA-LOCK Magnetic Chucks



JOB—mill clearance cut and 90° "V" cut on Carriage Rail Lower Race.

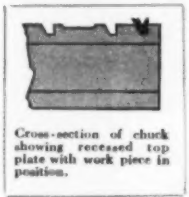
FORMER METHOD—climb milling (2 machines) two set-ups and two manually operated fixtures for each machine.

Production	70 pieces per hour
Cost	$0.0241 each
Rejects	25%
Total Scrap	6%

PRESENT METHOD—climb milling (2 machines) one set-up and one MAGNA-LOCK SUPREME 10" x 48" Magnetic Chuck* for each machine.

Production	200 pieces per hour
Cost	$0.00812 each
Rejects	None
Total Scrap	0.2 of 1%

*PAID FOR BOTH CHUCKS IN 57 WORKING DAYS



Cross-section of chuck showing recessed top plate with work piece in position.

C. J. Beard, Methods Engineer, Remington Rand, Elmira, New York, says:
"We are so well satisfied with the results of this set-up that we are in the process of tooling-up new parts, using MAGNA-LOCK Magnetic Chucks."

Write for *complete* details . . . Dept. AM-100

HANCHETT Magna-Lock CORPORATION
Magnetic Chucks and Devices
BIG RAPIDS • MICHIGAN • U. S. A.

Full Range of Steels Every Day at FLANNERY BOLT CO., Pittsburgh

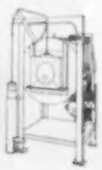
One furnace for all heat treating jobs is well demonstrated by another enthusiastic Delaware user.

Every day the Flannery Bolt Co. runs the full range of tool steels from carbon to high speed in their quick-heating Delaware Furnace. There is no de-carburization and work is completely scale-free due to the simplified controlled atmosphere system.

YOU can *confidently* and *economically* heat treat in your own shop with the easy-to-operate Delaware Furnace.

INFORMATIVE DATA is in 16-page Bulletin F-1. Send for your copy.

DELAWARE TOOL STEEL CORP.
WILMINGTON 99
DELAWARE



News about steel

FROM U-S-STEEL SUPPLY

EVENTS are changing so rapidly today that it is difficult to predict what lies ahead for the steel industry and its customers. However, we are in constant touch with Washington and our mill sources, and we will do our best to keep you advised about the steel situation as it affects you.

The latest news about the availability of steel in various sizes, forms and specifications, about acceptable substitutes and delivery dates . . . this type of information will always be as close to you as your telephone. We invite you to consider your U. S. Steel Supply representative as your Steel Service man who will give you up-to-the-minute news about the steel on which your business depends, and do his best to help you locate a supply.

And, of course, it goes without saying—we shall continue to give you the best possible steel supply service in the industry. Although some items are in short supply, our diversified stocks in 14 warehouses still add up to a lot of steel. Perhaps they contain exactly what you want. It will pay to check first with U. S. Steel Supply when you need steel.

WHEN YOU DEAL WITH US, YOU GET Service Plus!

UNITED STATES STEEL SUPPLY COMPANY

USS

Warehouses and Sales Offices:
BALTIMORE · BOSTON · CHICAGO · CLEVELAND · LOS ANGELES
MILWAUKEE · MOLINE, ILL. · NEWARK · PITTSBURGH · PORTLAND, ORE.
SAN FRANCISCO · SEATTLE · ST. LOUIS · TWIN CITY (ST. PAUL)
Sales Offices: INDIANAPOLIS · KANSAS CITY, MO. · PHILADELPHIA
ROCKFORD, ILL. · TOLEDO · TULSA · YOUNGSTOWN
Headquarters Offices: 208 S. La Salle St.—Chicago 4, Ill.

UNITED STATES STEEL

Fred M. Gillies has been elected executive vice president, Acme Steel Co., Chicago. He was works manager for Inland Steel Co. from 1922 until recently.

David R. Meslang has been named manager, Seattle branch of Crucible Steel Co. of America, New York.

Blake C. Hopper has joined the sales staff of Voss & Associates, Chicago sales representative of Automatic Transportation Co. He will cover the greater Calumet industrial area. **Arthur Ish** has joined the sales staff of E. C. Buehrer Associates, Automatic's San Francisco representative, to handle the East Bay area. **Joseph Lovrin** has joined the Buehrer service and inspection staff. **William Darrach** has been named sales engineer for J. M. Barclay, Inc., Newark, N. J., representative for Automatic, and **Russell P. Peacock** has been named service engineer by Nelson Equipment Distributors, Indianapolis representative for Automatic.

Sales Representatives Named

Hobart Brothers Co., Troy, Ohio, has named White Welding Supply Co., St. Louis, as representative in metropolitan St. Louis and the surrounding Missouri and Illinois counties.

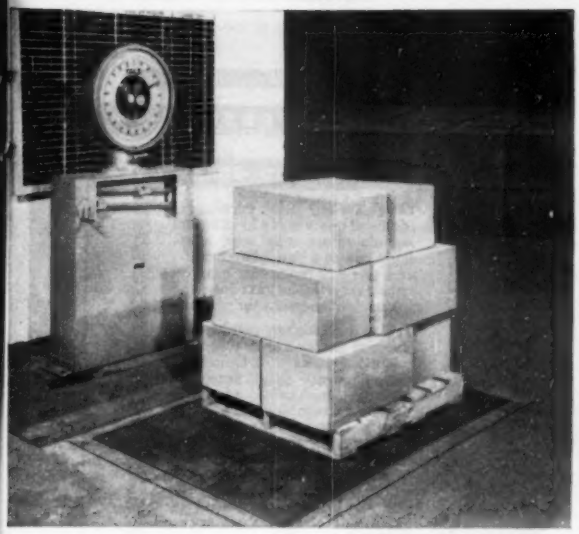
Hyster Co., Portland, Ore., has appointed Northeast Industrial Equipment Co., Inc., Cambridge, Mass., to handle sales and service of Hyster equipment in Maine, New Hampshire, Rhode Island and 10 counties of Massachusetts.

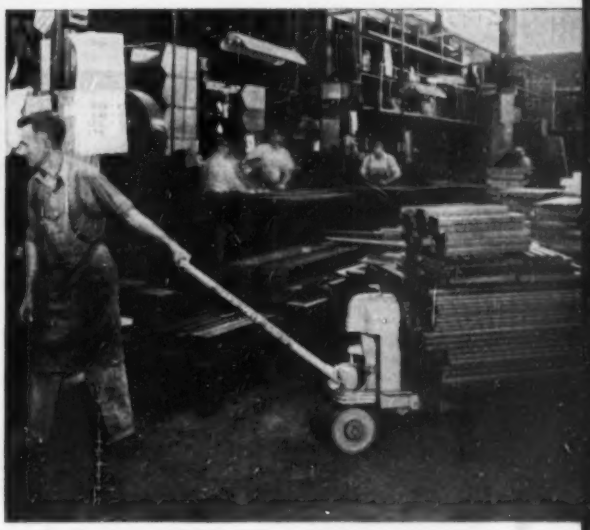
Radio Corporation of America, New York, has named Eriez Mfg. Co., Erie, Pa., distributor for RCA electronic metal detectors, handling all sales in the U. S. and Canada.

Ampco Metal, Inc., Milwaukee, has appointed Jaeger Welding Supply, Inc., Springfield, Mass., and Texas Welding Supply Co., Dallas, as franchised distributors in their respective areas.

Chicago Eye Shield Co. has appointed Guardian Safety Equipment Co., Birmingham, distributor for Alabama and Mississippi.

Lapeer Mfg. Co., Lapeer, Mich., has named Higginson Engineering Sales, Hamilton, Ontario, Canadian distributor for its Knu-Vise line of toggle-action clamps and pliers.





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YALE HANDLES MORE FOR LESS

Making is mostly moving. That's why maximum production economy can only be achieved with efficient tools to lift, transport, stack, and weigh materials.

Yale Material Handling Machinery is functionally designed to handle more for less. Thousands of companies are operating with vastly improved man-hour productivity and lower costs because of the speed and effort-saving efficiency of Yale tools.

Time is money. Get the most out of *your* production dollars. Put Yale Material Handling Machinery to work in *your* plant. Our nearby representative will gladly demonstrate how correct selection and application can cut costs substantially. Make a date. Phone or write today.

THE YALE & TOWNE MANUFACTURING COMPANY

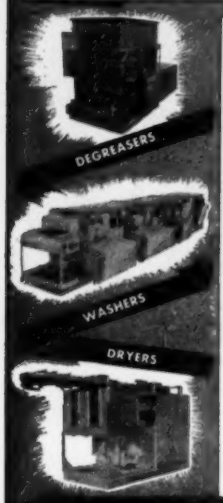
Philadelphia Division — Dept. L-189 — Philadelphia 15, Pa.

YALE

TOOLS THAT KEEP INDUSTRY "ON THE MOVE"

SCALES — Industrial • HOISTS — Hand and Electric • TRUCKS — Hand Lift · · Electric · · Gasoline · · Diesel

for METAL PARTS
DEGREASING, WASHING, DRYING



OPTIMUS VAPOR DEGREASERS—Vapor, vapor-immersion, vapor spray, and combinations. All sizes from small batch-type to large custom-built models.

OPTIMUS METAL PARTS WASHERS, single or multiple stage—screw-drum or conveyor, mesh belt or monorail types.

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Ideal degreasing solvents for all metals or combinations of metals. Warehouse stocks in all principal cities and industrial areas.

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Even though two supposedly identical gears made by different manufacturers may look alike, there can be a vast difference . . . and this difference can have an important effect on your costs and the performance of your product.

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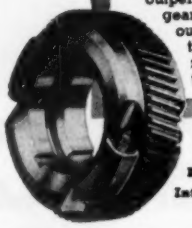

Spur • Helical • Rack • Worm
Bevel • Spline Shafts • Spiral
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"Gears Good Gears Only"
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Call **Grant FOR GEARS**

• Gears of all types • Speed reducers

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• MEISEL produces but one *kind* of gears . . . gears constructed for specific jobs. Only through the inherent accuracy of this special designing could such dependability, performance and economy be possible. Tell us what you expect it to do, and we'll show you the *one* gear suited for your job.

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UP TO 60" PITCH DIA.
UP TO 10" FACE WIDTH

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Going around in circles?

DON'T KNOW what copper alloy rod to use?

... here's a suggestion from CHASE

Is the rod you are using now the *best* choice for — speed of production — bending and forming—corrosion resistance—hot forging —strength—cold working—longer tool life—electrical or thermal conductivity—or any combination of these properties?

If you're not *sure*, write now for literature on Chase copper alloy rods giving you complete data, such as composition, forms and sizes, ASTM Specifications, relative machinability, tensile and yield strengths, Rockwell Hardness, elongation, shear strength, electrical and thermal conductivity, coefficients of thermal expansion, and melting range.

SEND FOR COMPLETE INFORMATION, FREE

Complete descriptive information about Chase Free-Cutting Brass, Bronze and Copper is yours for the asking.

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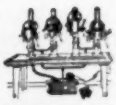
ALBANY ATLANTA BALTIMORE BOSTON CHICAGO CINCINNATI CLEVELAND DALLAS DENVER DETROIT HOUSTON INDIANAPOLIS KANSAS CITY, MO. LOS ANGELES MILWAUKEE MINNEAPOLIS NEWARK NEW ORLEANS NEW YORK PHILADELPHIA PITTSBURGH PROVIDENCE ROCHESTER ST. LOUIS SAN FRANCISCO SEATTLE WATERBURY

Nearly every mail brings requests for Johnson Bronze DATA SHEETS. This has been going on for over a year now. Men in industry who use bearings and engineers who design products using bearings are anxious to get the facts about them. These data sheets cover bearing types, bearing design, materials, powder metallurgy, tolerances, tests, lubrication, etc. They are written by engineers and research men, giving plain facts. These data sheets are printed on 8½ x 11 inch sheets for your convenience in filing. There are twenty sheets available now . . . more to come.

Johnson Bronze
SLEEVE BEARING HEADQUARTERS
515 SOUTH MILL STREET • NEW CASTLE, PA.

YOU ARE NOW READY FOR INCREASED PRODUCTION AT LOWER COST . . . PROLONGED TOOL LIFE . . . BETTER QUALITY WORK


FOR DRILL PRESS

FOR GRINDER

FOR LATHE

FOR CUTOFF MACHINE

Graymills Coolant Systems are made for 'round the clock operation . . . pumping coolants or heavy oils.

The above model G4-2-04, installed in 5 to 20 minutes, delivers enough coolant for a 5 to 8 spindle press. It is one of many complete Graymills Coolant Systems which will help you reduce tool costs, increase cutting speeds and improve quality.

RECOMMENDED AS REPLACEMENTS FOR MANY SMALLER COOLANT SYSTEMS WHICH ARE NOW BEING USED ON LARGER MACHINE TOOLS.

Used on all types of machine tools, the New Improved Graymills Coolant Systems are priced from $44.50. Gear and centrifugal pumps are 1/25 to ½ HP. 1 gal. to 70 g.p.m. Tanks 1 gal. to 38 gals. Fittings and recovery pans available.

*Model H-2-3325 $59.50

WRITE TODAY FOR NEW CATALOG AND ENGINEERING DATA DEPT. 2001

GRAYMILLS CORPORATION
Evanston, Ill.

You asked for it... HERE IT IS—

AO's New Metal Ful-Vue Safety GOGGLE!

HANDSOMER IN APPEARANCE • STRONGER IN STRUCTURE

With the introduction of the F4100 Metal Ful-Vue, AO's protection against the impact of flying particles reaches its highest development. Here in one goggle, with or without side shields, workers can obtain the peace of mind which comes from assured safety . . . the utmost in comfort over nose and temples . . . the very finest in EYE APPEAL PLUS EYE PROTECTION!

QUICK FACTS

NEW EYEWIRE — A major contribution to *looks with strength.* Outer edges are square instead of round with a deep groove to hold lenses securely in place. Beaded engraving adds a distinctive touch. The lightweight eyewire is strong and durable.

NEW RUGGED ENDPIECE—Streamlined . . . with a wide bearing surface at hinge which minimizes temple drop. Screw heads are countersunk and flush with endpieces for added good looks, non-sagging security.

NEW LIGHTWEIGHT TEMPLE—Oval temples instead of round for greater comfort and attractiveness. Easily adjusted, perspiration proof. Insulated semi or half tubing is another appearance improver and will outlast life of the temple. Tubing will not come off and it can't be discolored by dirt or grease. Both the temple and endpiece screws are AO patented "Ever-tite" construction . . . they keep tight in service yet remove quickly when replacing lenses.

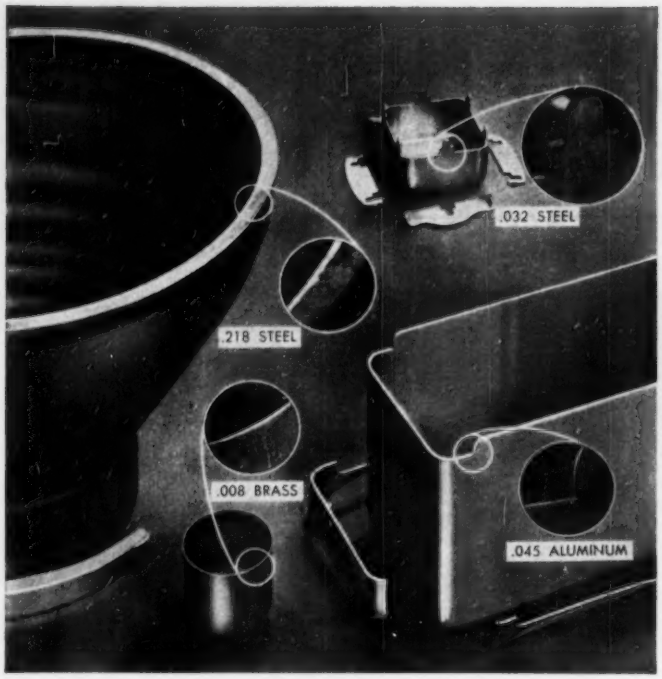
IMPROVED GUARD ARMS AND BRIDGE — Guard Arms are newly shaped — longer with more opening for added ease of adjustment. The bridge is double braced with four contact joints — a feature found only in AO Ful-Vue spectacle goggles.

NEW SIDE SHIELD CONSTRUCTION — A real time saver . . . new one-piece binder and eyewire construction *eliminates necessity of inserting the screen before inserting lenses!* Replacement of lenses can now be made without any interference with or from the side shield.

For these and many other reasons, be sure to see the new F4100. YOUR NEAREST AO SAFETY REPRESENTATIVE CAN SUPPLY YOU.

American Optical COMPANY
SAFETY PRODUCTS DIVISION

SOUTHBRIDGE, MASSACHUSETTS • BRANCHES IN PRINCIPAL CITIES



Could your shell be in this picture?

One of the amazing things about the Brehm Trimming Die is that stock thickness doesn't make much difference. Take a look at the shells shown above. They range from .008 brass to .218 steel. If you make a shell within that range, or maybe beyond it depending on material, you should be able to increase production and decrease cost with a Brehm Trimming Die.

Materials? Almost anything . . . gold, silver, stainless or mild steel, copper, brass, zinc, aluminum, fiber, rubber or plastics.

Thicknesses? In actual manufacture, from .008 brass to .218 steel, a range likely to cover most of your normal requirements.

Quantities? As high as 1200 per hour, where the small shell and scrap were blown from the die. Electric iron covers at 625 per hour, and large refrigerator doors at 264 per hour!

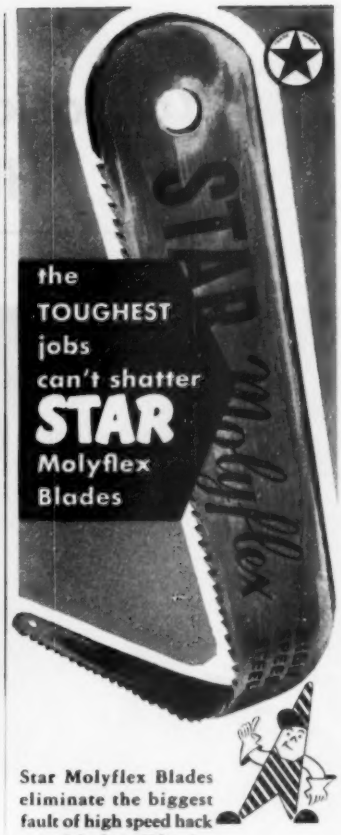
Shapes? Fountain pen ferrules, watch cases, cigarette lighters, burial vaults, cameras, automotive and kitchen accessories, radio and television parts . . . oh, well, never mind . . . what shape do *you* need trimmed?

The part . . . *your* part . . . may have straight or curved edges, notches, angles or projections. A Brehm Die will trim it completely in one press stroke, leaving full-metal thickness edges, no burrs and no draw marks on the shell.

Write today . . . for full details of the Brehm Trimming Die. The Steel Products Engineering Co., 1300 West Columbia Street, Springfield, Ohio.

THE "SHIMMY" DIE
REG. U.S. PAT OFF
®

Brehm®
TRIMMING DIES



Star Molyflex Blades eliminate the biggest fault of high speed hack saw blades. ***They're completely shatterproof and unbreakable in a frame.*** **That's true no matter how tough the job may be.**

And Molyflex leads the field in cutability. Tests prove that Molyflex Blades cut 23.8% better than the average of 8 leading brands of high speed flexible blades.

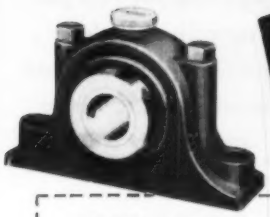
Your Star Supplier stocks the complete Star line of hand and power hack saw blades, frames and bands.

He also has the handy Star Wall Chart and the useful 32-page booklet, "Metal Cutting". Both are packed with valuable information on blades and cutting techniques. Get your copies today. They're FREE.

CLEMSON
BROS., INC. • Middletown, N.Y., U.S.A.
Makers of hand and power hack saw blades, frames, metal cutting band saw blades and Clemson Lawn Mowers

FRICTION is the second biggest cause of industrial fires. 14% of such fires are started by hot bearings, misaligned or broken machine parts, jammed materials. (From study of 20,000 industrial fires by Associated Factory Mutual Fire Insurance Companies.)

ANTI-FRICTION, ANTI-FIRE!



DODGE-TIMKEN BEARINGS

America's quality-proved line. Write for complete data. Four basic types and a vast range of sizes to meet your needs.

As a fire hazard and a power stealer, friction is a menace to production.

Dodge-Timken Bearings, noted throughout the world for their high quality, carry power smoothly, efficiently, with no overheating to cause disastrous fires, no excessive wear to cause bearing failure and costly production break-downs.

On millions of industry's toughest jobs Dodge-Timken bearings save power, reduce maintenance costs and keep production rolling steadily. Available from Dodge distributors' stocks — mounted, sealed, housed, fully assembled ready to lock on the shaft.

Get the facts about the important "firsts" in the Dodge line of power transmission machinery, which includes Bearings, Sheaves, Clutches, Couplings and the new Dodge Torque-Arm Speed Reducer.

DODGE MANUFACTURING CORPORATION • 100 UNION ST., MISHAWAKA, INDIANA

Call a Transmissioneer. He's factory-trained to help solve your power-drive problems. Look for his name under "Power Transmission Equipment" in your classified telephone directory.

DODGE

of Mishawaka, Ind.

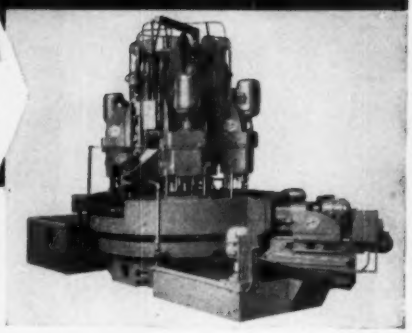
FIRST IN POWER TRANSMISSION MACHINERY

NAME PLATES

FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY, ETCHING COMPANY OF AMERICA, 1520 MONTANA STREET, CHICAGO 14, ILLINOIS

For High Production and Lower Unit Costs on Machine Tool Operations

...USE DAVIS & THOMPSON *Roto-Matics*



Here's a good example of the application of standard machine units to a special production job. Drilling and reaming operations of suspension support holes are performed on both right-hand and left-hand parts simultaneously. Drilling and reaming king pin holes is also included. Six stations, five operating and one loading, handle all operations with a total of 16 spindles. Machines of this type can be furnished from standard basic units for special applications on most all metalworking operations.

For Combined Operations or Single Purpose Machines

Machines similar to this can be designed to handle dissimilar operations in the same parts or one operation on continuous production. An indexing table with ROTO-MATIC POWER HEADS is easily arranged to suit special machining operations.

Lower Maintenance Costs with ROTO-MATIC Mechanical Power Heads

This machine is a good representative of the applications of D. & T. Roto-matic mechanical power heads. Six heads are used, three vertical and three horizontal. These new power heads lower maintenance costs through elimination of excessive servicing.

FREE DATA

will be furnished upon request. Write today. Ask for Bulletin AM.

DAVIS and THOMPSON *Roto-Matic*

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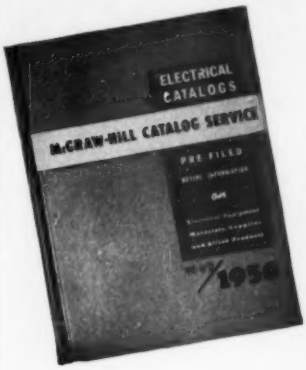

Several hundred pages of manufacturers' buying information will help you compare and select. The directory lists all known manufacturers, classified alphabetically and by product.

If the Pre-Filed ELECTRICAL CATALOGS are not available for buying reference at your plant, write to:

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From The *American Machinist* Library of *Tips for Top Shop Men*

IF you resent interruptions when you're busy, set the example by not interrupting others when they're busy. If you are careless with your men's privacy, you can expect them to be careless of yours.

PREJUDICE is usually blind ignorance. Sooner or later, the man who retains prejudices runs into trouble—and shows his inability to educate himself out of his narrowness.

ARISTOCRAT OF WORK BENCHES

. . . built for men accustomed to the finest tools and equipment

We "pulled out all the stops" when we designed the HALLOWELL Cabinet Bench, giving it more "custom" features than any other stock bench we know of. All-steel construction, choice of top materials, ample storage space, standardized units, interchangeable accessories, and trim good looks are just a few of its advantages.

Bulletin 702 tells the story. Write for your copy today!

See us at Booth 2434, Convention of National Metal Congress and Exposition, Chicago, October 23 to 27

Work Benches
Foreman's Desks
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Platform Trucks

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SHOP EQUIPMENT OF STEEL

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MODEL 720

NEW! HALLOWELL "UNI-TRUK" HAND TRUCKS

Available with one or two handles... send for Form 757-1. **"Try one and you will buy more!"**

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SPS STANDARD PRESSED STEEL CO.

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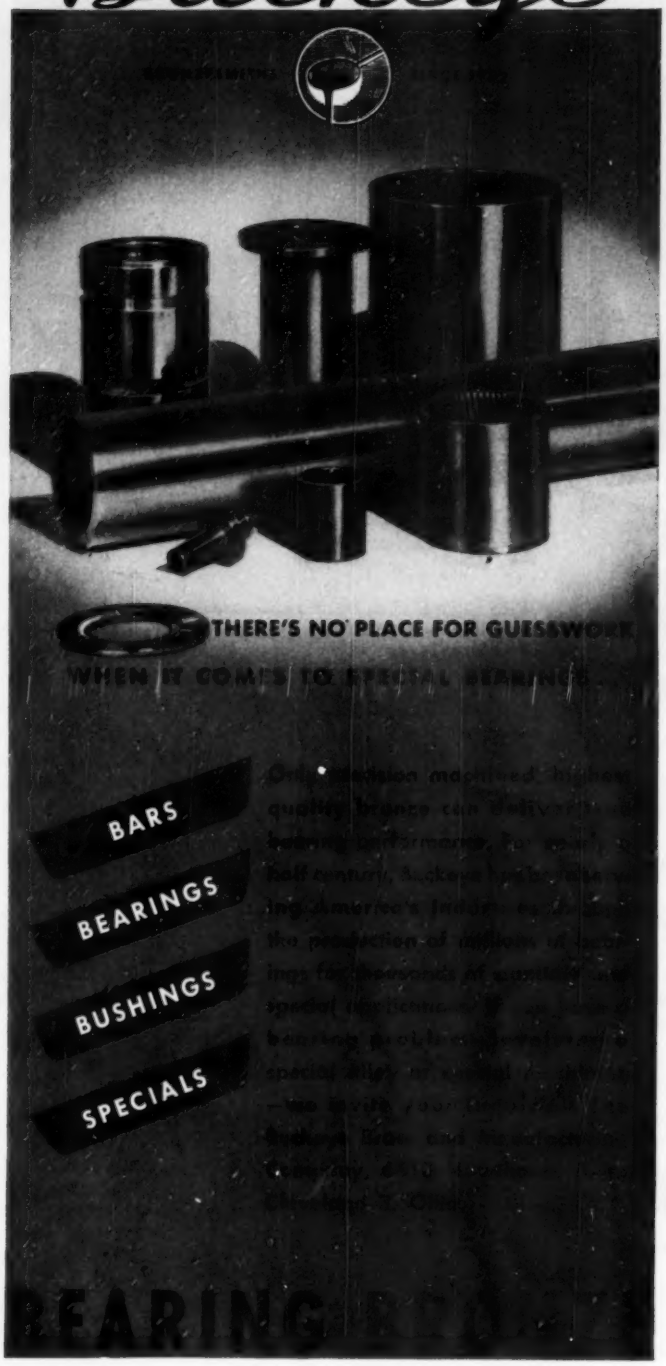

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Answers Your Everyday Welding Problems

The enlarged, authoritative twelfth edition of THE WELDING ENCYCLOPEDIA has ready answers to your everyday welding problems. More than 1000 pages covering . . .

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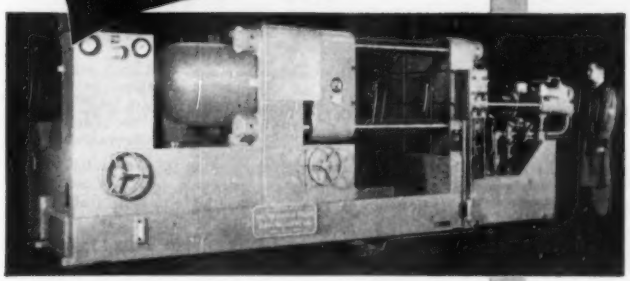
H-P-M's that Speed Up Die Casting PRODUCTION!

Whatever your production picture—large or small—there's an H-P-M die casting machine to bring in new profits. Follow the lead of Hoover, Westinghouse, General Electric, Western Electric, Chrysler, Emerson Electric, and many others for new production "highs" with H-P-Ms.

150-A For Small Die Castings

400-A For Big Die Castings



CHECK THESE H-P-M DESIGN FEATURES

THE H-P-M ALL-HYDRAULIC MOLD CLAMP, guided by four strain rods, assures positive mold alignment. Die change-over is simple and fast. Both clamp stroke and pressure are adjustable. Positive overload protection is provided at all times. High speed closing and opening, with automatic slow-down prior to mold contact, guarantees fast, shockless operation.

H-P-M AUTOMATIC CYCLE CONTROL permits maximum production. Manual effort has been minimized. Electric hand switches control mold clamp, hydraulic ejector and core pulls. A single Multiflex timer controls the automatic cycle after metal has been ladled into "cold" chamber. A selector switch is provided for manual operation of entire cycle, if desired.

THE H-P-M HYDRO-POWER OPERATING SYSTEM provides a direct and compact source of hydraulic power. All pumps, valves and controls are built by H-P-M for heavy duty service. Undivided responsibility to the user is guaranteed. Each pump is equipped with convenient volume and pressure controls. Only electric power and cooling water are required to operate these self contained machines.

Write today for Bulletin 4803, or better yet, call in an H-P-M engineer to discuss your particular problems.

SPECIFICATIONS

	MODEL NUMBER							
	150—A	150—Z	300—A	300—Z	400-A-M	400-A-S	400—AV	1000—A
SIZE OF DIE PLATES	24½x24½	24½x24½	34x34	34x34	38x38	45x45	36x36	56x56
SPACE BETWEEN BARS	15½x15½	15½x15½	23x23	23x23	23x23	30x30	36x36	31x31
DIE OPENS	12	12	14	14	16	16	20	24
MAXIMUM DIE SPACE	28	28	36	36	42	42	42	48
CAPACITY PER SHOT (LBS.)	4 (AL)*	10 (ZN)	5 (AL)*	20 (ZN)	12 (AL)*	12 (AL)*	12 (AL)*	20 (AL)*
NET WEIGHT (LBS.)	13000	16000	16000	19000	40000	44000	33000	103000

*NOTE: These models handle brass and magnesium die castings as well. Complete specifications on request.

THE HYDRAULIC PRESS MFG. CO. HPM **1042 Marion Road • Mount Gilead, Ohio**

HYDRAULIC MACHINERY **PUMPS • VALVES • MOTORS**

Revolutionizing Production with Hydraulics Since 1877

CARBIDE USERS:

Advantages for YOU

WITH ADAMAS CARBIDE

1.

Performance:
Top quality in every blank assures peak production in all applications with maximum speeds and feeds.

2.

Deliveries:
ADAMAS maintains the fastest delivery schedule in the carbide industry. Deliveries on specials are averaging one week. Standards are shipped from stock same day order is received.

3.

Lowest Prices:
ADAMAS standards and specials up to 18% below competitive level.

4.

A Complete Line:
Preformed and standard style blanks in almost any size or shape.
ADAMAS makes available to you engineered grades for all applications.

And take advantage of this . . .
Your copy of the newly revised Adamas "Comparison Chart of Cemented Carbide Grades" is ready. Write Dept. B

ADAMAS
CARBIDE CORPORATION
1000 South 4th Street • Harrison, New Jersey

Producers of top quality carbide for cutting tools, dies and wear resistance

From the *American Machinist* Library of *Tips for Top Shop Men*

THE more a man has to be told what to do, the less he's worth.

SUPERIOR people are uncommon. It's your job to take average people and get them to do superior work.

TELL your men what the company is doing—but beware of telling too much. The things most people want to know about are none of their business.

AN OPEN mind is an asset only if it can be closed for action after the whole question has been considered and a decision made.

EXPECT men to have complaints. It's human nature, and besides, reforms come only from below. No man with four aces yells for a new deal.

AN OLD country saying is "Them that can brag *without lying*—let 'em brag." Remember the "lying" part particularly.

Here's Why it Pays You to Read the Advertising

The advertising is a rich source of valuable information. In this magazine it offers you ideas and products that may well apply advantageously to your business.

Every issue is a catalog of goods, materials, and services — quickly available to you—just for the reading.

Leaders in business and industry turn to the advertising because they've discovered it helps them run their businesses more profitably.

When you read all the ads in this magazine, the chances are good that you'll get a lead that will materially help you do a better job. For example, you may find a specific piece of equipment that will be a profitable time-saver. Or a tool that will increase worker efficiency. That's why it pays to read the advertising. It's good business.

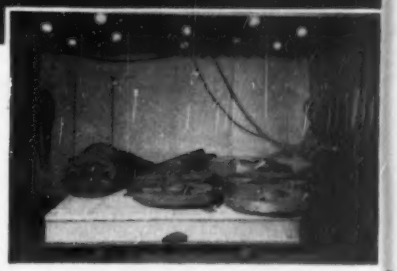
HEADQUARTERS FOR BUSINESS INFORMATION

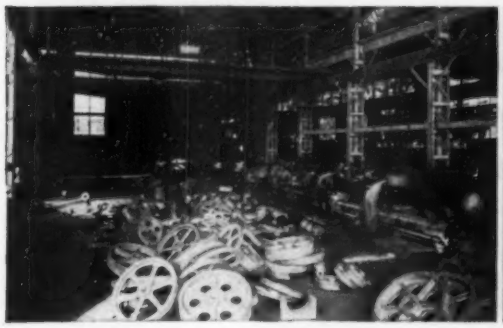
McGRAW-HILL publications

F-25

Symbol of Highest Quality

Modern cleaning and annealing equipment in the National Erie Medium Foundry includes Pangborn Rotoblast, batteries of swing grinders, turntable cars, 75 ton annealing furnaces . . . All modern facilities which reflect in the quality of National Erie castings and gears. Write for your copy of bulletin No. 7.

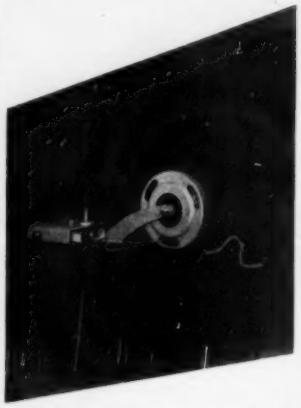




NATIONAL ERIE CORPORATION

ERIE, PENNSYLVANIA • U. S. A.

NOW ! MAKE YOUR OWN SPRINGS



Any drill-press operator can quickly set up the Spring-Master and make precision and quality springs, singly or in quantity, of almost limitless variation as to size, pitch and length. It is now proving essential by daily use in top-flight industrial organizations or in the most modest machine shop in solving the costly spring maintenance problem.

COST—$65. FOB SAUGUS, MASS. Includes three multiple-use spindles and a one-pound coil of spring wire to get you started. Send now for complete information.

10-DAY FREE TRIAL OFFER

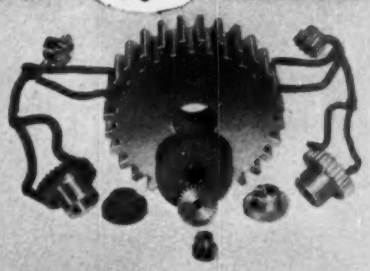
CYCLOID CORPORATION, Saugus, Mass. Gentlemen: I agree to make a trial use of your Spring-Master. At the end of 10 days I will return in good condition—or—honor your invoice for $65. promptly.

Name .....

Company .....

Address .....

Mass. G&T Gear



...for FAST SERVICE on All Types of MEDIUM AND SMALL SIZE GEARS

Many members of the Mass Gear organization have been with the company since its founding twenty-eight years ago. They have grown up with "Mass Gear" . . . . . in planning, producing, inspecting and shipping.

Their long-experienced "know-how" has been concentrated on the interpretation of customer requirements and in meeting them intelligently and promptly.

●

If you have a gear problem, let Mass Gear help you. Write for a free catalog to Massachusetts Gear and Tool Company, Woburn, Mass.

Massachusetts Gear & Tool Co.

For quick, accurate, on-the-spot hardness testing, reading directly in the Rockwell scales.

Ames PORTABLE HARDNESS TESTER

Flat and round bars, sheets, tubing and wire are tested on the spot without cutting off specimens. Punches, dies, cutters, saws and odd-shaped pieces are tested before and after heat treating. Used by metallurgists, inspectors and heat-treaters. Sizes for work 1" to 6" round and flat. Send for illustrated circular.

Comes complete with anvils, penetrators, test blocks and carrying case.

AMES PRECISION MACHINE WORKS

Makers of Precision Bench Lathes & Milling Machines

WALTHAM 54, MASSACHUSETTS

How to save $4247 a year

by investing only $2471!

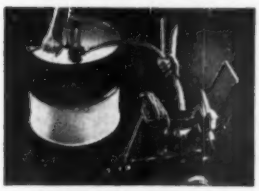
It all started with a test on a single mammoth high speed machine, in a Chicago plant* where machine break-downs and bearing replacements were frequent, stock spoilage and rejects were high, and oil consumption ran to $5664 a year!

After a month's test of Alemite Centralized Lubrication on this one machine, the system was installed on all five other machines in the plant at a total cost of only $2471. Since that time, there has not been a single break-down or bearing loss, stock spoilage and rejects have been greatly reduced, and lubricant cost has been cut to $1417! This is an annual saving of $4247, *in addition* to more production gained from each machine, and a marked product improvement for increased customer satisfaction!

No matter what size or type of plant you operate, an Alemite Lubrication Engineer can show you dozens of ways of making worthwhile savings through more efficient handling of petroleum products. These are facts which you can readily confirm in your own time studies. The Alemite man will cooperate fully with your plant engineers in setting up a test. Contact your local Alemite Industrial Distributor now. Or send for free booklet "11 Ways to Cut Production Costs." Mail coupon below to Alemite, Dept. A-00, 1850 Diversey Parkway, Chicago 14, Illinois.

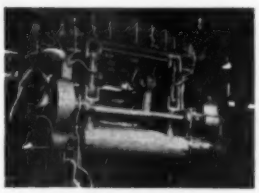
**Name on request.*

Alemite Cuts Costs 3 Ways



1. ***In Transferring Lubricants...*** by eliminating mess, expensive contamination—and cutting man hours 63% for every 100 pounds of lubricant transferred.

2. ***In Loading Grease Guns . . .*** by saving 3¾ man hours for every 100 pounds of lubricant loaded into hand guns.



3. ***In Applying Lubricants . . .*** by saving up to 23.9 man hours for every 100 pounds of lubricant applied to bearings.

ALEMITE

MEANS EVERYTHING FOR LUBRICATION

1. Methods 2. Lubricants 3. Equipment

Another Product of Stewart-Warner

FREE! New Booklet

"11 Ways to Cut Production Costs"...

(simply attach to your letterhead)

Alemite, Dept. **D-100**
1850 Diversey Parkway, Chicago 14, Ill.

Please send me without charge or obligation your booklet "11 Ways to Cut Production Costs."

Name _____

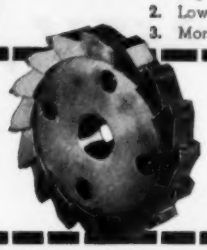
Company _____

City _____ *State* _____

Cut your costs 3 WAYS

with these **NELCO** *Carbide Tipped Tools*

1. Higher table feeds
2. Lower relative power consumption
3. More pieces per grind



NELCO Tri-Helix Carbide Tipped Face Mill . . . for milling STEEL

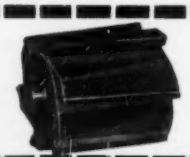
FEATURES: — Tri-helix cutting faces that keep their edges and stay sharp longer. (In actual tests, 125 cubic inches of cast steel per minute were removed with a consumption of only 60 horse power.)

SIZES: from 6" diameter through 14" diameter.

NELCO Carbide Tipped Fine Tooth Face Mill . . . for milling cast iron, brass, bronze.

FEATURES: Double the usual number of teeth for extra engagement, smoother running, higher feeds and greater cutter life.

SIZES: 6, 8, 12 and 14 inch diameter



NELCO Carbide Tipped Slab Mills . . . for milling (series 300) cast iron, bronze and brass; (series 400) aluminum, magnesium and similar metals.

FEATURES: Spiral tooth design plus the standard features mentioned below.

SIZES: 2½" to 4" in dia.—1" to 6" in width.

All three incorporate such standard Nelco design features as alloy steel bodies, slash milled carbide tip seats, nickel shim brazing and large overhanging carbide tips so that it is not necessary to grind steel when regrinding tools.

WRITE for descriptive literature and name of your **NELCO** distributor.

NELCO TOOLS

For that Extra Edge in Production

NELCO TOOL CO., INC. MANCHESTER, CONNECTICUT

IT TAKES TIME!

It takes time to make any change of address on a subscriber's stencil plate. . . .

It takes time to correct all the records, so his regular copy of *American Machinist* will reach him at his new home or place of business.

These are two good reasons why we urge you to notify us at least a month in advance of any address change you are planning. Don't forget to take care of this important matter, so you'll be sure of not risking a hitch in *American Machinist* service! Write. Include your name, old address—new address and about when you will move. Your cooperation will be appreciated!

American Machinist

***Circulation Department*, 330 West 42nd Street, New York 18, N. Y.**

How to read with your eyes open for business!

Read the ads! Every issue of this magazine contains ads that offer valuable services and useful products by which your business may be run more profitably.

The time it takes to read all the ads is time well spent. One ad alone can pay off—by informing you of new developments and new sources of supply, by helping you do a more efficient job. For example, you may locate one machine that will cut your production costs, or step up your output. Or you may discover that the equipment you've been waiting for is now available.

This magazine displays more ideas and merchandise than a trade exposition. Make every issue your buyer's guide. Read the ads as well as the articles. That's reading with your eyes open for business.

HEADQUARTERS FOR BUSINESS INFORMATION

McGRAW-HILL publications

F-24

"I wasn't asleep," said the Dormouse

EVERY boy and girl knows the drowsy Dormouse of Alice in Wonderland. He was elbowed and pinched by the Mad Hatter and the March Hare as he mumbled in his sleep at the tea party.

But our young people aren't so well versed in everyday economics. They have a sadly distorted picture of the profits of business. They don't realize why profits are necessary, how small they are, or how they are divided.

For instance, in a recent survey of high school seniors, it was discovered that they believe over 50% of the sales dollar is profit and they think stockholders receive 24% of it. Actually business profit averages less than 8%, with less than 3% distributed as dividends. Business uses most of its profit, moderate as it is, for new plant and equipment, to improve products and to make more jobs.

Misconceptions among our youth bode ill for America's future. They open the door for too ready acceptance of dangerous isms and false foreign philosophies. Such misunderstanding of economics can be corrected only with facts supplied by business itself. You as a leader in your community must share this responsibility.

The American business man must not allow himself to be cast in the role of the Dormouse, pinched and pilloried by the March Hares of communism and the Mad Hatters of the "everything for nothing" state.

THE YOUNGSTOWN SHEET & TUBE CO. 1900 YOUNGSTOWN 1950 50 YEARS OF SERVICE

The Youngstown Sheet and Tube Company

General Offices -- Youngstown 1, Ohio
Export Offices--500 Fifth Avenue, New York

MANUFACTURERS OF CARBON, ALLOY AND YOLOY STEELS

ELECTROLYTIC TIN PLATE - COKE TIN PLATE - WIRE - COLD FINISHED CARBON AND ALLOY BARS - PIPE AND TUBULAR PRODUCTS - CONDUIT - RODS - SHEETS - PLATES - BARS - RAILROAD TRACK SPIKES.

SAVE SANDING COSTS

. . . how Production Wise Manufacturers cut expenses with AP Jewel Abrasives

FINISHING METAL

Corners and edges of stainless steel cabinets on these automatic dishwashers must be carefully polished after welding. This manufacturer, not satisfied with results, switched to AP's No. 80 Jewelox Cloth X73. Now reports: *"This cloth is the best we've ever used!"*

FINISHING WOOD

Fine chests and cabinets require a velvet-smooth finish. This prominent manufacturer tried AP's Bondite New Process Paper Belt — made like all Jewel Belts with AP's exclusive Velvet Joint that will never jump or scratch — got a 50% improvement in results over *all* previously used abrasives.

FINISHING PLASTICS

Phenol plastic switch plates can be a tricky finishing problem. This manufacturer called in AP Engineers who recommended cool-running Silver Streak Belts. Result: Silver Streaks did 25% more work than other belts — eliminated spoilage — cost not a penny more.

Have *you* got a finishing problem? Whatever your requirements, chances are you, too, can do faster, better work — at lower cost — with AP Jewel Coated Abrasives. See your distributor or write us today!

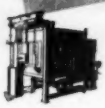
Abrasive Products, Inc.

SOUTH BRAINTREE 85, MASSACHUSETTS • MAKERS OF JEWEL COATED ABRASIVES

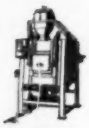
'Surface'

STANDARD RATED ATMOSPHERE FURNACES

FOR ANY SURFACE PROTECTED HEAT TREATMENT



"BALCO"
with built-in RX Atmosphere Generator



"CHAR-MO"
with built-in Char-Mo Atmosphere Generator

"ATMOTROL"
Vertical or horizontal muffle types utilizing exterior atmosphere source (generator or cylinder)

MUFFLE FURNACE
with cooling chamber. Utilizes exterior-atmosphere source.

ATMOSPHERE GENERATORS
for any requirement

Write for new bulletin SC-148 for complete details.

SURFACE COMBUSTION CORPORATION
TOLEDO 1, OHIO

WE INCREASED PRODUCTION 71% WITH J&L "E" STEEL

J&L STEEL

(a story* about how to win customers and influence prospects)

"Got a minute? Well, let me tell you about what happened at our machine shop a couple of months ago when we first tried that new J&L "E" Steel. You wouldn't believe it was possible! (Confidentially, neither did we until we proved it to ourselves.) Here's what happened.

"We got an order to produce a big lot of plunger stops for solenoid starter switches. They're tricky to run, and you've got to be pretty careful every second. We'd read about "E" Steel in some of J&L's ads, and decided we might try some on this job.

"So we ordered some 17/32" E-33 "E" Steel stock, set up our B&S #2 and B&S #0 Automatics and began to turn out parts. We had used B-1113 for this job before and had been getting 350 pieces per hour. But we soon realized we could machine much faster with "E" Steel, and **we kept increasing speed until we were getting an average of 600 parts per hour. That's a 71% production increase!**

"Next thing we discovered was that our tools were lasting twice as long and the chips were coming off better with "E" Steel than they did with B-1113. We also found that the finish on the parts had improved from 20% to 25%.

"That's why we've been using "E" Steel. We turn out work much faster and can take on more jobs. Our men like the way "E" Steel machines and our customers get better parts and better service. Everybody benefits!"

Get your copy of the booklet titled "A Progress Report on 'E' Steel." It outlines a series of 11 case histories from machine shops that have used "E" Steel with excellent results. Write for your copy.

Based on an actual case history.

"E" Steel (U.S. Pat. No. 2,484,231) is easily identified by the distinctive blue color on the end of every bar.

Jones & Laughlin Steel Corporation
402 Jones & Laughlin Building
Pittsburgh 30, Penna.

Please send me a free copy of "A Progress Report on 'E' Steel."

Name_____

Title_____

Company_____

Address_____

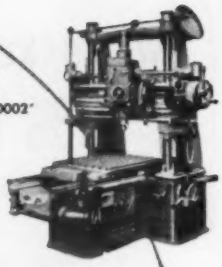
JONES & LAUGHLIN STEEL CORPORATION

From its own raw materials, J&L manufactures a full line of carbon steel products, as well as certain products in OTISCOLOY *and* JALLOY (*hi-tensile steels*).

PRINCIPAL PRODUCTS: HOT ROLLED AND COLD FINISHED BARS AND SHAPES • STRUCTURAL SHAPES • HOT AND COLD ROLLED STRIP AND SHEETS • TUBULAR, WIRE AND TIN MILL PRODUCTS • "PRECISIONBILT" WIRE ROPE • COAL CHEMICALS

Optically Set
JIG BORING AND *MILLING* MACHINES

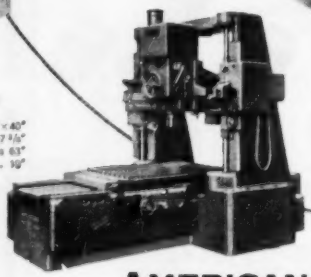
Hydroptic-B
Working range . . . . . 40" × 28"
Table top to spindle end . . . 28 ¾"
Free space between uprights 39 ¾"
Boring capacity . . . . . 9"
Guaranteed accuracy: .0002"



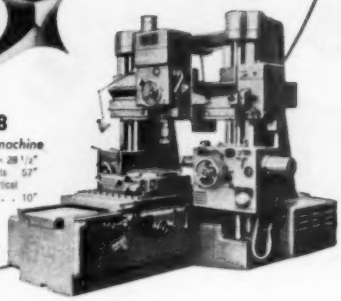
No. 2H
Working range . . . . . 16" × 10"
Table top to spindle end . . . 19"
From spindle axis to column 13 ⅜"
Boring capacity . . . . . 1⅝"
Guaranteed accuracy: .0001"

SIP

Hydroptic-7
Working range . . . . 66" × 40"
Table top to spindle end . 37 ⅜"
Free space between uprights 63"
Boring capacity . . . . . 90"
Guaranteed accuracy: .0002"



Hydroptic-8
Three-coordinate machine
Working range 55" × 40" × 28 ½"
Free space between uprights 52"
Boring capacity of both vertical and horizontal spindles . . 10"
Guaranteed accuracy: .0002"



AMERICAN SIP CORPORATION
HIGH PRECISION MACHINE TOOLS AND MEASURING EQUIPMENT
100 East 42nd Street NEW YORK 17, N. Y.

SPEED PACKAGING, REDUCE COST

SEALED IN STEEL

7 gallon container with metal cup mount for aircraft engine parts.

REUSABLE AIRTIGHT CONTAINER FOR SHIPPING and STORAGE

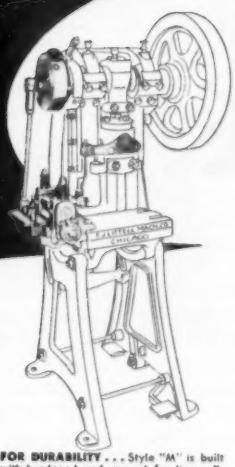
SDPA Containers and inner packs guarantee that products can be shipped and stored without damage, ready for use when needed. A special pack can be designed for your product if standard types cannot be used.

For catalog & specifications Write Dept. AM-1

STEEL DRUM PACKAGING & ACC. INC.
9505 SANDUSKY AVENUE • CLEVELAND 5, OHIO

FOR LOW COST AND BIG RESULTS
Feed Your Presses With

LITTELL
STYLE "M" AUTOMATIC
ROLL FEED



FOR SPEED . . . With Style "M" automatic feeding your press can easily produce 9,000 stampings an hour at 200 strokes per minute, or 4,600 stampings an hour at 100 strokes per minute.

FOR VERSATILITY . . . Style "M" feeds left to right, right to left and front to back. Feed direction can be reversed by simply reversing clutch. Feed lengths per stroke are 0 to 4⅛" with standard gears and 0 to 8½" with compound gears.

FOR ADAPTABILITY . . . Style "M" is adaptable to any standard punch press. It feeds coil stock up to 8" wide and up to .055" thick (17 gauge).

FOR SAFETY . . . Style "M" automatic feeding keeps hands and fingers away from danger, prevents costly accidents.

FOR DURABILITY . . . Style "M" is built with hardened and ground feeding rolls and the other quality features that have made Littell Roll Feeds accurate and durable since 1918.

FOR ECONOMY . . . Style "M" brings you a big saving in price. It gives your presses the lowest insurance rate. It cuts your cost per stamping by multiplying press output.

WRITE FOR CATALOG

F. J. LITTELL MACHINE CO.
ROLL FEEDS • DIAL FEEDS • STRAIGHTENING MACHINES • REELS • AIR BLAST VALVES
4105 N. RAVENSWOOD AVE. • CHICAGO 13, ILL.

P&H helps you

cut fabricating costs on "hard-to-weld" steels •

Have superior physical qualities — ideal for welding heavy sections that must withstand severe shock and abuse.

Low-Hydrogen Electrodes

- ***For problem steels:*** High carbon, high sulphur, cold-rolled, alloy... *70LA.*
- ***For steel castings repair:*** matches analysis and heat-treating properties of Grade B castings... *P&H25C.*
- ***For welding nickel-alloy steels;*** gives high impact resistance at low temperatures... *75LP.*
- ***For chrome-moly steels*** (1% Cr., ½% Mo.) used in power piping ... *80LE.*
- ***For chrome-moly steels*** (2% Cr., 1% Mo.) used in power piping ... *90LE.*
- ***To match heat-treating properties of SAE 1040*** and like steels. Also for steel-castings repair... *P&H40C.*
- ***For welding high hardenable steels.*** Also steel castings repair... *AW2B.*
- ***For repair welding Grade C castings*** and steels of similar composition... *P&H #7.*
- ***Comparable to SAE 8630 steel...*** excellent heat-treating and flame-hardening characteristics... *90LH #2.*
- ***For welding high hardenable steels*** without preheat such as re-rolled rail stock... *P&H #12.*
- ***For aircraft and similar steels*** . . . has wide range of properties under heat treatments... *P&H #21.*

Withstand high amperages and have high deposition rate. Operators burn more rod per hour, weld faster at lower costs.

These rods operate with stable arc on AC or reverse-polarity DC. Other money-saving features are: Elimination of underbead cracking. Low hydrogen content for successful enameling. Little or no preheating. Minimum spatter. Excellent appearance of weld... freedom from surface holes. Order from your P&H representative or local P&H distributor. Send coupon for detailed information.

P&H WELDING DIVISION
Milwaukee 14, Wis.
HARNISCHFEGER CORPORATION

HARNISCHFEGER CORPORATION, Welding Division
4514 W. National Ave., Milwaukee 14, Wis.

Please send me complete information on money-saving P&H Low-Hydrogen Electrodes.

Name.....

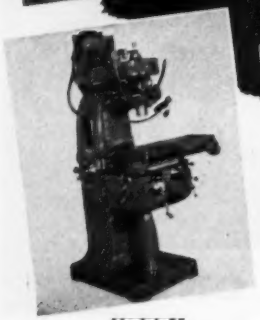
Company..... Title.....

Address..... Home ☐ Business ☐

City..... ( ) State.....

EXCAVATORS • OVERHEAD CRANES • HOISTS • ARC WELDERS AND ELECTRODES • SOIL STABILIZER • CRAWLER AND TRUCK CRANES • DIESEL ENGINES • CANE LOADERS • PRE-ASSEMBLED HOMES

EXTRA CAPACITY and VERSATILITY are definite advantages of INDEX Milling Machines



Model 55

Model 60

IDEAL FOR THE TOOL ROOM—EXCELLENT FOR LIGHT PRODUCTION—

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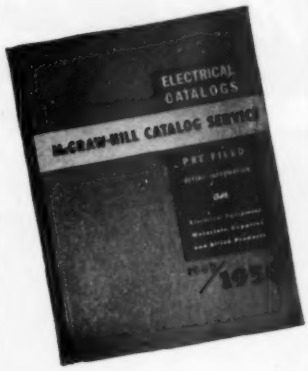

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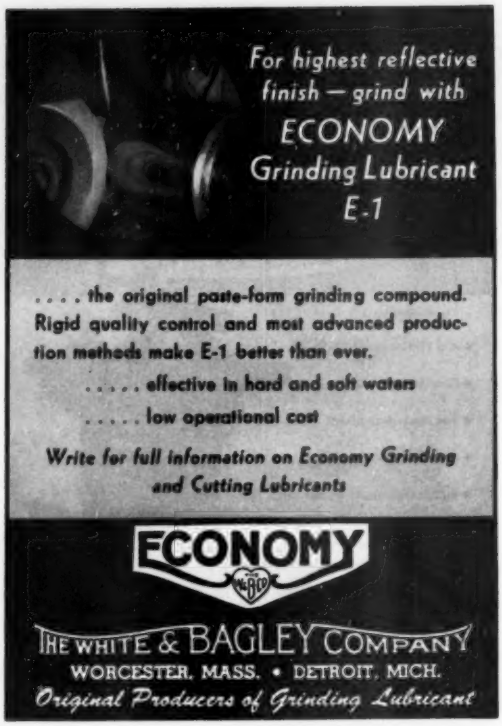
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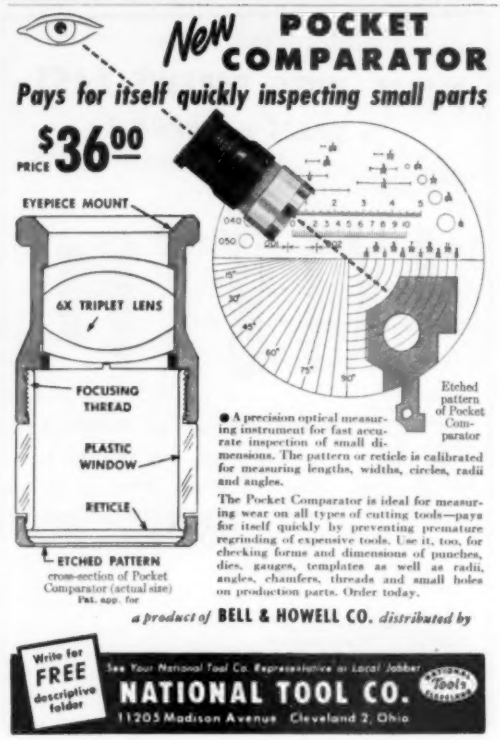
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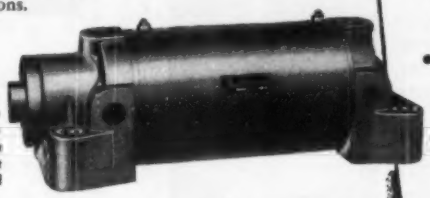

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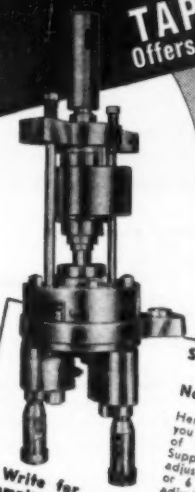

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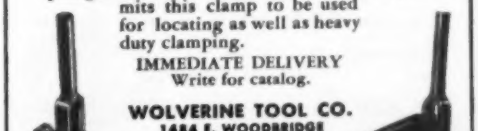

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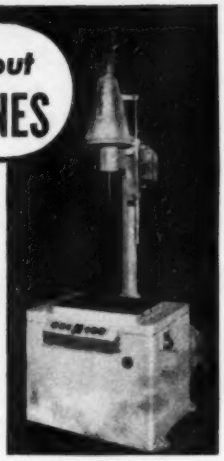

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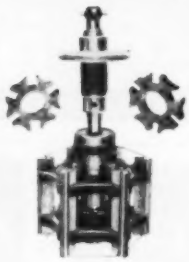

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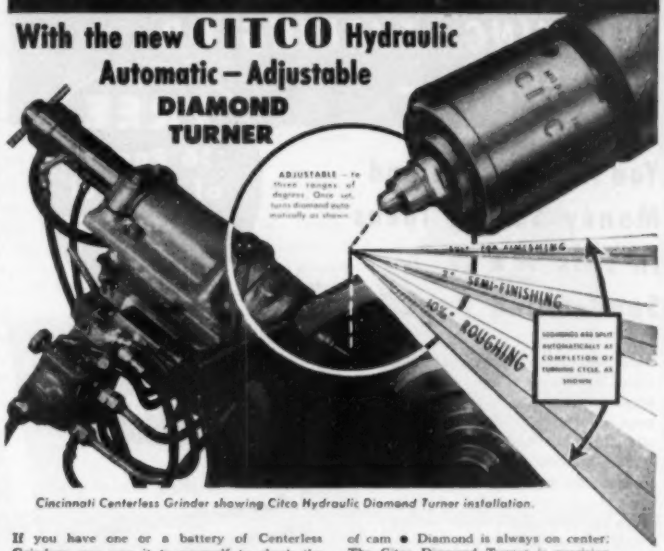

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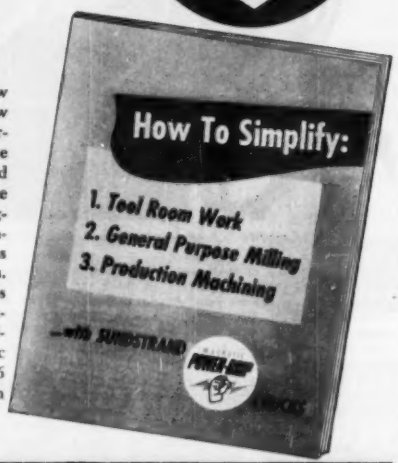

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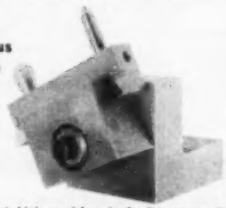

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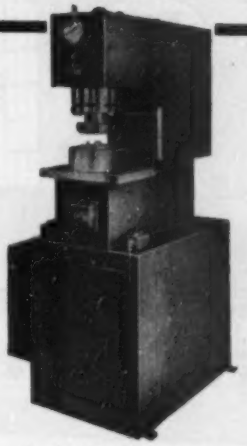

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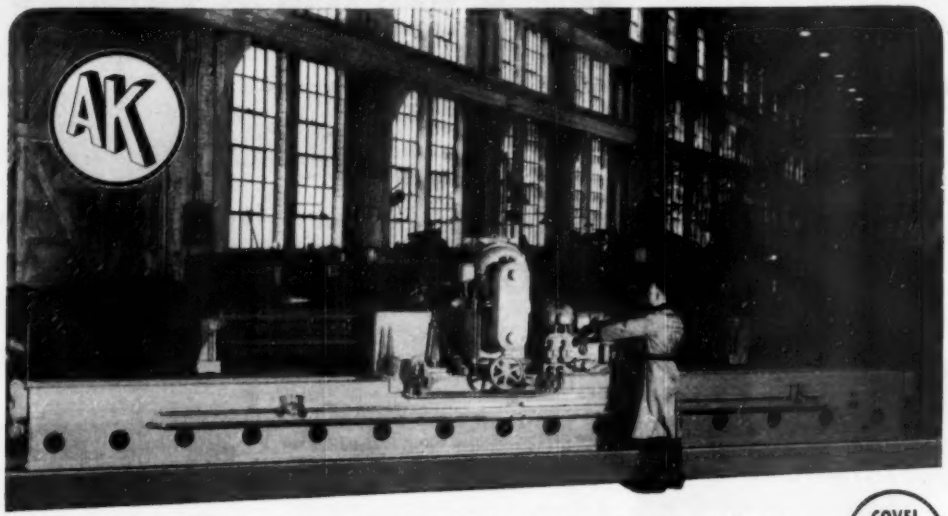

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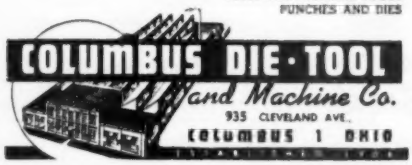

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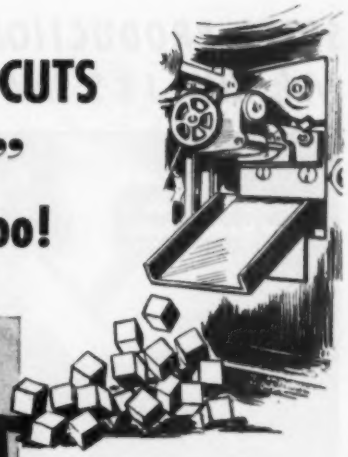

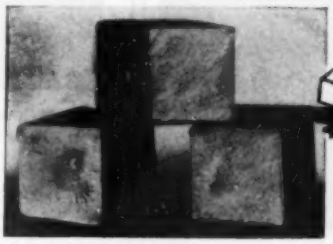

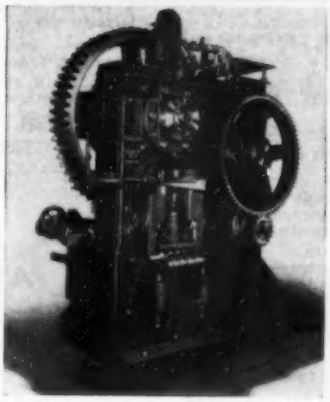

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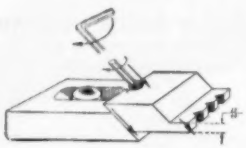

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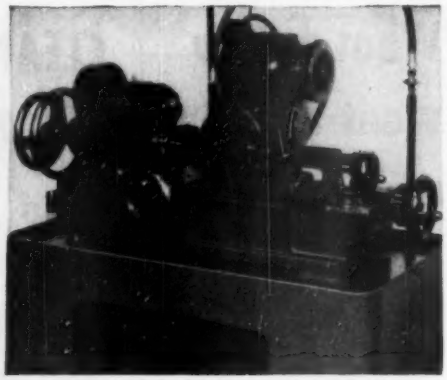

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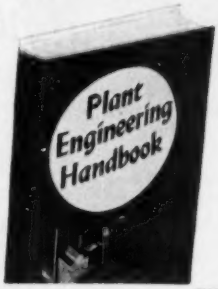

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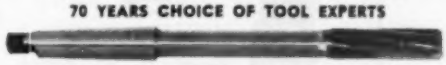

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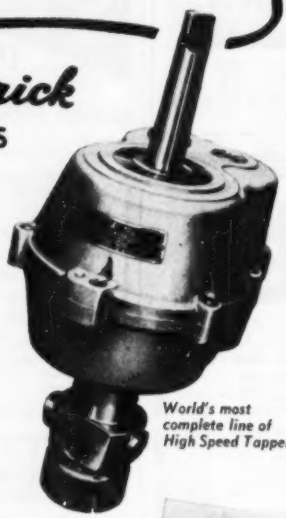

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Mechanical Engineer with shop, design and sales experience has $20,000 with services to invest in small going shop. BO-7864, American Machinist.

PATENT ATTORNEY

Patent Practice

before U.S. Patent Office, Validity and infringement investigations and opinions. Booklet and form "Evidence of Conception" forwarded upon request. Lancaster, Allwine and Rommel, Registered Patent Attorneys, Suite 453, 815 15th Street, N.W., Washington 5, D.C.

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10x24" Logan, cone, motorized
12x30" centers American Geared Head, m.d., late
12x30" centers Monarch Geared Head, m.d.
12"x6' Lodge & Shipley Geared Head, m.d., Taper
13x30" centers Pratt & Whitney Model B, m.d., taper
13x48" centers Pratt & Whitney Model B, m.d.
14x30" Lodge & Shipley Selec. Head, m.d., latest
14"x54" centers Lodge & Shipley, m.d., latest
14"x6' bed Hendey Geared Head, m.d., taper
14"x6' Lodge & Shipley Geared Head, m.d.
14"x6' Pratt & Whitney, cone
14"x6' LeBlond, cone
14"x6' Sidney Geared Head, m.d.
14"x6' Springfield Geared Head, m.d., taper
14"x8' Prentice, m.d., taper
14"x8' Pratt & Whitney, cone
14"x8' Sidney G.H., m.d.
15"x6' LeBlond Geared Head, m.d.
16"x30" Rand-Prentice, m.d., latest
16"x36" Pratt & Whitney Geared Head, m.d.
16"x50" centers Pratt & Whitney, cone, motorized
16"x6' Bradford, cone
16"x6' Hendey Geared Head, m.d.
16"x6' Hendey Yoke Head, taper
16"x6' bed LeBlond, cone
16"x6' Lodge & Shipley Selec. Head, m.d.
16"x6' Lodge & Shipley, cone
16"x6' bed Monarch Geared Head, m.d.
16"x8' Lodge & Shipley, cone, motorized
16"x8' Lodge & Shipley Geared Head, m.d. in leg, taper
16"x8' Monarch, m.d. in base, taper
16"x8' Monarch, cone
16"x8' Sebastian, cone
16"x10' Hendey Yoke Head, taper
16"x14' Greaves-Klusman, m.d. in leg, taper
17"x6' LeBlond Geared Head, m.d.
17"x8' LeBlond Geared Head, m.d., taper
18"x40" centers Lodge & Shipley, m.d., taper
18"x52" centers American Geared Head, m.d., taper
18"x5' LeBlond Geared Head, m.d.
18"x6' bed Lodge & Shipley, cone, motorized
18"x6' Monarch Geared Head, m.d.
18"x6'6" Greaves-Klusman Geared Head, m.d. in leg
18"x7' Hendey Geared Head, m.d., taper
18"x8' American Geared Head, m.d.
18"x8' Champion, cone
18"x8' Hendey Geared Head, m.d.
18"x8' Lodge & Shipley Selec. Head, m.d.
18"x8' Lodge & Shipley, cone
18"x8' Whitcomb-Blaisdell Geared Head
18"x10' Bradford, cone, motorized
18"x10' Cincinnati, cone
18"x12' LeBlond, cone, motorized
18"x13' centers American Geared Head, m.d., late type
19"x6' LeBlond, cone
19"x8' bed LeBlond Geared Head, m.d., taper
20"x8' American Geared Head, m.d., taper
20"x8' Cisco, cone
20"x8' Greaves-Klusman G.H., m.d. in leg
20"x10' Sidney Geared Head, m.d.
20"x11' Lehmann Geared Head, m.d., taper
22"x70" centers Greaves-Klusman Geared Head, m.d., taper
22"x8' Lodge & Shipley, cone
22"x10'6" Greaves-Klusman, cone, motorized
23"x12' LeBlond Geared Head, m.d., taper
24"x10' American, cone
24"x10' Greaves-Klusman Geared Head, m.d., taper
24"x10' Lodge & Shipley, cone
24"x12' Bridgeford Geared Head, m.d., taper
24"x12' LeBlond, cone
24"x22' American Geared Head, m.d., taper
25"x10' LeBlond, cone
26"x8' Bridgeford Geared Head, m.d.
30"x12'6" Niles-Bement-Pond, m.d., taper
30"x13'6" Niles-Bement-Pond, m.d.
32"x12' Lehmann Hydratrol Geared Head, m.d., taper, latest
33"x12' Greaves-Klusman, cone, motorized, taper
36"x38'6" Niles Heavy Duty, m.d., latest, 2 carriages
36" American Triple Geared Internal Face Plate Drive, m.d., taper
48"x12' bed American, m.d.

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No. 0 Sundstrand Rigidmill, m.d., latest
No. 00 Cincinnati Model EA, m.d., latest
No. 12 Brown & Sharpe, m.d.
No. 1-12 Cincinnati, m.d. latest
No. 2-16 Cincinnati, m.d., with rise and fall, latest
No. 2-24 Cincinnati, m.d., latest
No. 2-24 Cincinnati, m.d., with rise and fall, latest
1A Sundstrand Copy Rigidmill, md.
No. 4-48 Cincinnati Plain Hydromatic, m.d., latest
No. 4-48 Cincinnati Duplex Hydromatic, m.d., latest
M36 Milwaukee Simplex, m.d., late
No. 34-36 Cincinnati Duplex Hydromatic, m.d., with tracer control, latest
No. 34-36 Cincinnati Plain Hydromatic, m.d., with tracer control, latest
No. 34-60 Cincinnati Plain Hydromatic, m.d., latest
No. 56-72 Cincinnati Duplex Hydromatic, m.d., latest
No. 56-90 Cincinnati Duplex Hydromatic, m.d., latest
Type P Ohio Mfg., m.d.
Sundstrand Rigidmill, m.d.
4" Pratt & Whitney Spline, m.d.
No. 33 Kempsmith, s.p.d.
18", 24" Cincinnati Plain Automatic, m.d.
24", 48" Cincinnati Duplex Automatic, m.d.
30"x36"x12' Ingersoll Slab Milling Machine, 2 heads, m.d.
48"x48"x20' Ingersoll Fixed Rail Milling Machine, for tank work
72"x6' Ingersoll Single Horizontal Spindle Traveling Housing Milling Machine, m.d.

THREAD MILLING MACHINES

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No. CT-36 Lees-Bradner, m.d., latest
No. CT-54 Lees-Bradner, m.d., latest
Hall Planetary, m.d.
4"x12", 6x14", 6x20", 6x40", 6x60" Pratt & Whitney
10x24" Hanson Whitney, m.d., latest
10x48" Hanson Whitney, m.d.

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CINCINNATI: #2M Vertical, Rotary table
CINCINNATI: 6-S Vertical
SUNDSTRAND: 9B Rigidmil—Duplex (for milling cam tracks in propeller hubs or similar work)
SUNDSTRAND: #6D Rigidmil—Hydraulic
SUNDSTRAND: #9 Rigidmil
MOREY: 12M 2-spindle Profiler
TAYLOR-FENN: M-8B Duplex Splines
TAYLOR-FENN: Vertical 6"x21" Table
RICE-BARTON: Duplex Splines
VAN NORMAN: 10CT Contour Miller

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HANSON-WHITNEY 3"x10" Thread Miller
MOREY: 12"x90" Thread Miller
LEES BRADNER: 40A Thread Miller
LEES BRADNER: LT 6x30" Thread Miller
HALL PLANETARY: B, C & D Thread Millers
MURCHEY: #22 Tapper, Horizontal
PRODUCTO: Hand Tapper
MATCO: Vertical Tapper 16 spindle

TOOL SHARPENERS
OLIVER: 2A Face Mill Grinder
OLIVER: 510 Drill Sharpener
OLIVER: 10" Tool Bit Grinder Template Type
FELLOWS: Flat Top Helical Gear Cutter
RANSOM: 2-wheel grinder 5 HP

GRINDERS—THREAD
EXCELLO: #31 & #33 External
JONES & LAMSON: TG-636 External
JONES & LAMSON: TG848 External
JONES & LAMSON: TG1245 External

GRINDERS—CYLINDRICAL
NORTON: 6"x18" & 10"x18", Plain
NORTON: 10"x18" 45° angle wheel head
NORTON: 12"x36" Universal
LANDIS: 18"x18" "C" Plain Hydraulic
LANDIS: 18"x32" Type "D" Crankpin, Hydraulic
CINCINNATI: #2 Centerless
CINCINNATI: 8"x18" Hydraulic Filmatic
BROWN & SHARPE: #10 & #23 Plain

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BRYANT: #5 and #5Y Internal
BRYANT: 160B Internal
HEALD: #55 Planetary
HEALD: 70A Plain Internal
HEALD: 72A3, 72A5 Plain & Universal
HEALD: 72A3 Sizematic Centerless
HEALD 72A5 Sizematic
HEALD 172 Sizematic for Cylindrical Cams
BRYANT: 112 Universal, Hydraulic
BRYANT: 16-28 Hole Grinder
BRYANT: 24-36 Heavy Duty Internal
RIVETT: #104 Tool Room Universal

GRINDERS—RADIUS
VAN NORMAN: #73, 638, 648 Oscillating
VAN NORMAN: #3½ Universal

GRINDERS—SURFACE
THOMPSON: 8"x12"x18" Type B
THOMPSON: 12"x18"x96" Type C
HEALD: Rotary 8" dia. chuck
HEALD: #22 Rotary—12" Chuck
GARDNER: 12DA Opposed Head Disc

HONING & LAPPING
BARNES: 306 N Vertical
MICROMATIC: M-510 Double End Horizontal
MICROMATIC: H-2 Single End Horizontal
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BARBER-COLMAN: #3 Hobber
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CLEVELAND: #140 Hobber—1 spindle
FELLOWS: 6Z2 Shaper
FELLOWS: 6I, 6IA, 6IA, 7 & 72 Gear Shapers
FELLOWS: Straight Line Generator
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GOULD & EBERHARDT: 12H Hobber, 18" dia.
GOULD & EBERHARDT: 36BM Cutter
HAMILTON: #1 Hobber 6" diameter
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GLEASON #13 Universal Gear Tester
GLEASON: #4 & #6 Bevel Gear Testers, Hand & Power Operated
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ILLINOIS: #224 Involute Checker and Recorder
RED RING: BIC-12" Gear Tester
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PRECISION BORING
BARNES: #412 Horizontal 60" Travel
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HEALD: 47A Single End 2-spindle
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LATHES—PRODUCTION
POTTER & JOHNSTON: #4D Automatic
SUNDSTRAND: 8x15 & 12x22 Stub Lathes
LODGE & SHIPLEY: #3A Duomatic
LIPE-ROLLWAY: 15"x30" Carbomatic
LEBLOND: 25"x48" Engine Lathe, raised to 40"

LATHES—TURRET
BULLARD: 24", 30" Vert. Spiral Drive
WEBSTER & BENNETT: Vertical Turret Lathes 30", 48" and 60" sizes
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LELAND-GIFFORD #2LMS Deep Hole Vertical
BARNES: 20H½, 2 spindle on 4 spindle base
BAKER: 30H0 2 spindle inverted 4" dia. cap.
BAKER: 217 Upright Heavy Duty
FOSDICK: #48M Upright High Speed
PROVIDENCE ENG: 6-spindle ⅝" capacity
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ARCHDALE: Radial, all sizes (New)

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ACME-GRIDLEY: RA6 9/10" 6-spindle

MISCELLANEOUS
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BLOUNT: Polishing Lathes 12x48
GARDNER: #6 Disc Grinder
ALLEN #2 Stud Setter
CAMPBELL: #425 Abrasive Cutalator
WILLIAMS: 10" Pipe Cut-Off
TANNEWITZ: GH-36 Band Saw High Speed
RANSOME: #30 Welding Positioner Motor Drive
KENT: 3½" Bar Pointer and Chamfer
MATTHEWS 78A Marking Machine
GENERAL: #33 Flexible Press
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OSBORN: 682 Jett Rollover for Foundry
GENERAL ENG.: Riveter 24" throat

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LATHE—Engine, Mackintosh-Hemphill, 72"/110"x30' Centers (1943)
VERT. MILL—Cinc. Hydrotel #28/60, 4- spindles, Tracer (1942)
CRANE—150 Ton x 30' span, Whiting, Bridge, 3 hook trolley.

BORING MILLS—D & H 3½" horiz., floor. Vertical Turret Lathe, 30". Bullard, 72", 2 swivel heads on rail (old).

DRILL PRESS—Minster #2D, 2½" cap. Hvy. Snyder, 1½", 28" swing.

GEAR SHAPERS (2) Fellows #6.

GRINDER—Surface, Reid, Model 2-1 (late)

LATHES, Engine — Sebastian 16"x36" Centers (late). Turret—Foster #18 Universal, Chucker, 2⅜".

MILLERS—Newton Vert. 42' Rotary Hvy. Cinc. #3 Vert. Hi Power. Br. & Sh. #3 Universal. Cinc. #08 Vert. (late).

PUNCH—Sq. end, Smith 1-1/16" thru ⅝"

ROLLS, BENDING—H. & J. 30'x¾", Pyr. Southwark 15'x3" Vert. Niles, 11'x¾", Initial.

ROLLS, ANGLE—Bertsch 3"x3"x⅜".

SHEARS—Alligator (#2) 24" blade, 3" Rds. Rotary, Quickwork #50A, 48"x¾" (late).

THREAD MILLS—Morey 12"x10' Centers (late). Lees-Bradner 9"x36" Centers.

THREADER, BOLT—Acme 2½" cap.

PRESSES—Z & H #7, 50 ton Percussion. Bliss #6, 125 ton, dbl. action 5" & 2" St., roll feed and scrap cutter (late). Bliss #78½, 450 ton, 18" Stroke. Dominion, 200 ton, Hydro Dynamic (New).

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All Late Type

54" Bullard Vert. Turret Lathes (2), latest type
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40"x15' LeBlond Engine Lathe, latest type
Bullard Multaumatics, 16", 12", 8", late
Sgl. Spdl. Cleerman (1949)
Sibley (1941) Drill Presses, #5 M.T.
#28/60 Cincinnati Hydrotel 4 Spdl., '44
9/16", 2¼", 2⅜" RA6 Acme Gridley Auto.
20" Gould & Eberhardt Shaper
Hardinge Multipurpose Chucking Machine, 1950
60" Bickford Vertical Boring Mill
75 Ton Henry & Wright Dieing Press
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B & S No. 000 Mills, 1942.
American 25-ton Vertical Broach.
Sheffield Thread Grinder.

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Cone 4 Sp. 1¼" Autos.
Fay Automatic, 12"x81".
Lodge & Shipley Duomatic 2A

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Lucas No. 31, 32 horiz.
Heald #49 double spindle, #48A Borematics
Bullard 24", 36", 42" VTI.
King 72", 42" vertical

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Barnes No. 242, No. 5 Morse
Carlton 8'-19" column
Canedy-Otto 3'-9" rad.
Defiance 112—21" No. 4MT
Fosdick No. 5RM
Sibley 24"-28", Power Feeds
Hamilton, Langelier, Hi-Speed

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Gorton No. 2U, 3Z.
Deckel G2, 2 dimen & G1L
Gorton Cutter Grinders 376-2, 265-6.

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Fellows #7, 72, 712, 725, 7125. High Speed.
Fellows 645Y Spur & Spiral
Gleason #2 Surface Hardener
Gleason 3" Straight Bevel Generator
Michigan, Gleason, Fellows Checkers.
Mikron Gear Hobber.

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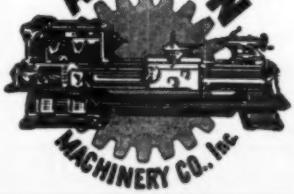
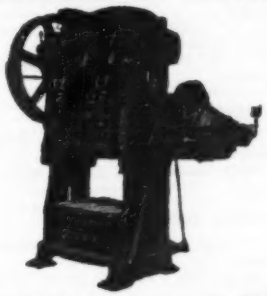
Brown & Sharpe No. 5 cyl. 3" x 18", 3" x 12".
B. & S. Nos. 1, 3 Univ.
B. & S. No. 13 Univ. & Tool.
Bryant #216 Internal
Cinn. 12x48", & 12x36" Filmatic Univ.
Covel No. 91A Univ. T. & C.
Dalzen Thread, latest
Gardner #226, 30" Disc.
Hanchett #228 Disc. Dbl. opposed w. M.D. Feed.
Heald 72AS Sizematic Int. Centerless
K.O. Lee Tool & Cutter.
Landis, 10x24" type C Univ., 10x36" angu., centreless
Norton No. 2 Tool & Cutter, Hyd.
Oliver 510 Drill Grinder, Sellers 4G Drill Grinder
Wickman Profile

GRINDERS, SURFACE
Abrasive No. 33, 34 Vert. 8x24.
Blanchard No. 11, 16" Mag. Chuck.
Brown & Sharpe #5, 8x24"
G & L Hyd. #24, 6x18", #35, 8x24", #46, 12x24".
Hanchett Model 300, 13 x 48".
Norton 6x18", and 10x36" Hyd.
Reid No. 2A P.F. MIB.
Reid No. 2C Motor Spdl. Hand Feed.
Thompson Hyd. 6 x 10 x 18", 6 x 12 x 18"

LATHES
Hardinge Precision, 1" Collet Cap.
Hendey 12" x 42" GH
LeBlond Heavy duty 16"x78"
LeBlond Regal 16"x24", 18"x24", 15"x30", 16"x48" TA. 19"x48". TA. 21"x60"
Lodge & Shipley 20"x54" G.H. 24 Spindle Speed latest





Bliss Double Crank Toggle Press No. 406—48"

Bliss #3½A Toggle Press Geared, 1½ Toggle
Bliss No. 304A, 78½ (330 ton) Straight Side Presses.
Bliss 650 High Production Presses.
Cincinnati 36-72 Hydrotel Horiz. Miller latest type.

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MANUFACTURER	TON CAP.	STR.	OPENING	PLATEN
Lake Erie	500	36"	48½"	35 x 36
H.P.M. Double Action	500	24"	30"	36 x 36
Watson Stillman Shaft Straightener	500	24"	57"	24" bed.
Denison	25/50	18"	23"	22 x 20
Hannifin	50	20"	30"	22 x 30
Southwark, D. A. Clamping Plate	125	30"	2' to 4'	84 x 30
Oilgear Shaft Straightener	35	8"	12"	84 x 11

DOWN MOVING RAM, WITHOUT POWER UNIT

Mesta	750	42"	80"	44 x 44
Chambersburg	300	10"	27"	22 x 36
Southwark	350	42"	78"	28 x 48
Southwark	550	23"	68½"	42 x 32

UP MOVING RAM PRESSES

Southwark	600	20"	27" to 48"	34 x 24
Waterbury Farrel	800	6½"	28"	22 x 24
Birdsboro	800	20"	30" to 48"	40 x 32
Watson Stillman	300	12"	21"	24 x 20
Watson Stillman	300	12"	19"	20 x 20
HPM	180	15"	14½"	30 x 30
Dunning & Boschert Molding Press	300	12"	38"	24 x 32 Mold
Stokes Molding Press and Pump	200	8"	30"	24 x 24
Elmes—With Elec. Plates	50	6"	12"	18 x 18
Stewart Bolling	85	10"	19"	20 x 20

WHEEL PRESSES

NILES — 600 ton 96" 500 ton — 48"; 300 ton — 48.

INJECTION MOLDERS

ACCUMULATORS

Mfr.	Size	Pounds
HPM	6" x 9'	2000
General Electric	15" x 11'	400
Watson Stillman (13 gal) Hydr. Pneu.	42 x 9 x 48"	3000

Lodge & Shipley 16 x 78" T.A. Collets, etc., 20"x54" 24 speed G.H.
Monarch 10"x30" EE.
Monarch 12x30" Dble. Compound, 18"; 12"x30" CEK
Rivett 608 QCG, TA, Precision
South Bend Q.C.G., 13"x6', 10"x4'

MILLS, PRODUCTION
Brown & Sharpe, No. 000, 12, 21
Cincinnati No. 2-18 Mfg., 50-96 hydromatic
Kent Owens IV, 1-5
U. S. Multimiller, 1 & 2 Spindles.
Sundstrand 00 Rigidmills

MILLS, PLAIN AND UNIVERSAL
B. & S. No. 2A Univ.
Cincinnati No. 3 Plain, 2M Plain
Cincinnati No. 2MH Univ., H.S.
Milwaukee 2HL, 2H Univ., H.S.
Milwaukee No. 2H Plain, 2 HL
Van Norman Duplex, 20.

MILLS, VERTICAL
Brown & Sharpe No. 2 Standard.
Cincinnati No. 3 Hi-Speed Dial Type.
Cincinnati No. 4, Hi-Power.
Gorton No. 6½ D Profiler
Morey No. 12M Profiler 2 sp.
Sipp MPS Jig Borer
Fosdick #30 Jig Borer.
Pratt & Whitney #2 Jig Borer

PLANERS
Detrick & Harvey 48"x48"x18' open side 2 Rail heads, 1 side head.
Hamilton 30"x30"x10' double housing.
Hamilton 36"x36"x22' double housing.

PRESSES
Bliss No. 18, 19, 20, 21, OBI.
Bliss No. 304A, 4" Str. 13"x24" bed, S.S.
Bliss No. 644B, 650 Hi-Production, 58, 62, 62A, 162.
Bliss No. 4½ Double Action Cam
Colton Tablet Presses.
Gen. Flexible Screw Press.
Z. & H. 30 Ton, O.B.I.
Stokes Tablet Presses, Model R & T, DD2.
V&O #01

TURRET LATHES
Acme No. 6 W Bar and Chuck, Acme Fox.
Bardons & Oliver No. 3, 1⅛" cap., No. 6, Chuck.
Brown & Sharpe 2F
Foster No. 3B.
Gisholt No. 4, Bar and Chuck, 2L, Saddle Type
Jones & Lamson #5 Univ. Preselector head, PRT
Warner & Swasey #5 Preselector
Warner & Swasey No. 4A 8" Cap.

MISCELLANEOUS
Band Saw: DoAll 36" Zephyr, Tannewitz No. 36M.
Bending Roll: Webb ¼"x8', BR-3
Centering Machine: Sundstrand.
Comparator: J & L 14" pedestal & bench.
Die Casting Machine DCMT
Hacksaw: Marvel Nos. 6 and 6A, 9A Automatic Feed.
Marking Machine: Noble & Westbrook
Notching Press: Ferracute C82.
Pin Machine: Nilson.
Profilers: Cinn. 360° 4 Sp., Morey 12M
Shaper: Cinn. 24" Universal. Sheldon 12" Brand New.
Rotary Shear: Quickwork 3/16" Cap. 36" throat circle cutting attach.
Hone: Micromatic Hydrohoner, Sunnen.
Keyseaters: Mitts & Merrill, Baker, Burr, Davis.
Lappers: Ultralap.
Rivet Hammers: Hi Speed.
Toolmakers Microscope: Gaertner, Bausch & Lomb, Leitz
Tapper: Bakewell #1, #2, Haskins No. 3C, 3 Cam, Globe.
Welders: Spot & Seam: Thompson, Taylor, Winfield.
Wrapping Roll: #⅛ Buffalo

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14' Niles Tool Works Boring Mill

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No. BL-2 Natco Multiple Spindle Drill
6' 17" Column American Radial Drill
No. 2-KH 6-Spindle Allen Drill Press

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6" x 18" Norton Type C Plain Cylindrical Grinder
10" x 36" Model "EA" Cincinnati Plain Cylindrical Grinder
16/20" x 72" Norton Type C Cylindrical Grinder

GRINDERS, INTERVAL

No. 16-16 Bryant Int. Hydraulic Hole Grinder
No. 72A3 Heald Plain Int. Hydraulic Grinder

GRINDERS, SURFACE

No. 11 Blanchard High Power Vertical Rotary
No. 16 Blanchard Vertical Spindle (30" Chuck)
No. 22 Heald Rotary Surface Grinder
Model "B" Pratt & Whitney Surface Grinder
16 x 24 x 72" Mattison Surface Grinder

GRINDERS, UNIVERSAL

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No. 3 Brown & Sharpe Universal Grinder
14" x 72" Norton Universal Cylindrical Grinder

LATHES

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14" x 16' Coulter Thread Cutting Lathe
20" x 72" Lodge & Shipley Engine Lathe, Model X
Bridgeford 28" Swing x 30' Bed Geared Head

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No. 1H-18 Kearney & Trecker Manufacturing Type Mill
30" x 30" x 14' Ingersoll Adjustable Rail Mill
No. 2-HL Kearney & Trecker Plain Mill
1248 Kearney & Trecker Simplex Miller
No. 3 Van Norman Plain Horizontal Mill
No. 4 Cincinnati Dial Type Plain Mill

MISCELLANEOUS

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No. 24-H Gould & Eberhardt Hobber
No. 2 Cincinnati Centerless Grinder
36" American "Heavy Pattern" Universal Shaper
No. 214 Besly Disc Grinder

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G & L and Universal 3" Bar Horiz. Boring Mills
20" All Grd. Camel Back Drill
Cin-Bick 3' & Morris 3½' Arm Radial Drills
Blanchard M.D. Vert. Sp. Surface Grinder 26" chuck
L & S 20" x 8', 18" x 21', 20" x 10', 28" x 12'
Monarch 20" x 8', Amer. 20" x 12' grd. hd. q.c.g. m.d. Engine Lathes
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B & S No. 2-A & 3-A, Mil. No. 2-B, Cin. No. 1-M, Cin. No. 2 Grd. Hd. Univ. Millers
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BULLARD 24", 36", 42" Vert. Turret "Spiral Drive", High Speed, Latest Type
COLBURN 72", 2 swivel heads, PRT, M.D.
NILES 100", 2 swivel heads, Rapid Traverse, AC M.D.

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LELAND & GIFFORD #1LMS, 4 Spindle, Latest Type
LELAND & GIFFORD—2, #3MS Single Spindle
NATCO #4AL Multiple, 30 spindles, Hyd, Latest Type

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BARBER COLMAN #13 Hobber, Single and Double Precision, Motor Drive
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BROWN & SHARPE #13 Spur and Bevel Cutter, M.D.
CROSS #1 Tooth Rounding Machine, Motor Drive
CROSS #50 Gear Chamferer, Latest Type
FELLOWS Model 61, 61A, 6Z2, 7A, 72, 725, 7125, 75 High Speed Gear, Shaper, Latest Type
FELLOWS #12M Involute Measuring Instrument, latest
FELLOWS #12LS Lapper, latest type
FELLOWS #14 Hypoid Spiral Grinder, Latest Type
GLEASON #14 Hypoid Spiral generator, latest type
GLEASON 5", 12" straight bevel generator, latest type
GLEASON #1, #6, #18 Bevel and Hypoid Tester
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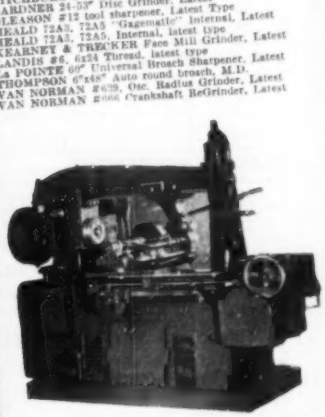
GOULD & EBERHARDT 18H Hobber, Motor Drive
GOULD & EBERHARDT 90H Hobber, with diff. M.D.
NEWARK #5, 72" Hobber with Infeed and Differential, Motor Drive
PRATT & WHITNEY 10" Grinder, hyd., latest
SCHUCHARDT & SCHUTTE #1 Hobber, Motor Drive

GRINDERS—Cyl.—Plain & Univ.

BROWN & SHARPE #1, 2, 3, 4, Universal, Latest
BROWN & SHARPE #5 Plain, 3 x 12, Latest Type
CINCINNATI 16"x30" Model H.B., Univ., Latest Type
LANDIS 4x12, Type H, Plain Hyd., Latest Type
LANDIS 6"x18" Type C Plain, Hyd., Latest Type
LANDIS 22"x130" Plain Roll, Motor Drive
NORTON 6"x30", 10"x72" Type C, Plain, Latest

GRINDERS—Miscellaneous

BARBER COLMAN #3, Hob Sharpener, Latest
BROWN & SHARPE No. 13 Univ. Cutter & Tool, Lat.
BRYANT #3, #6, 16-C-16, 16-CP-16, 24-36" Internal, Hydraulic, Latest Type
CINCINNATI "Monobet" Tool & Cutter, Latest
FITCHBURG 14"x25" Spline hydraulic, latest
GARDNER 24-30" Disc Grinder, Latest
GLEASON #12 tool sharpener, Latest Type
HEALD 72A3, 72A5 "Gagemaster" Internal, Latest
HEALD 72A3, 72A5, Internal, latest type
KEARNEY & TRECKER Face Mill Grinder, Latest
LANDIS #6, 6x24 Thread, latest type
LA POINTE 60" Universal Broach Sharpener, Latest
THOMPSON 6"x48" Auto round broach, M.D.
VAN NORMAN #679, Osc. Radius Grinder, Latest
VAN NORMAN #666, Crankshaft ReGrinder, Latest



BARBER COLMAN Type A Gear Hobbing Machine Capacity — 12" diameter; 12" face; 3 D.P. Motor Drive.

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BLANCHARD #11, 16" dia. mag. chuck, Latest
BLANCHARD #16, 24" dia. mag. chuck, Motor Drive
BLANCHARD 10A Vertical, Dial Feed, Motor Drive
HANCHETT Series 200 12"x48" Vert. Hyd., Latest
HANCHETT Series 200 30x120" Plano, Hyd., Horiz, Latest
HEALD #22 Rotary, 12" chuck, latest type
HEALD 25A—rotary—24", 30" chuck, Hyd., Latest

JIG BORERS

KEARNEY & TRECKER Model B Automatric, Latest
KNIGHT #4 Precision, Late Type
PRATT & WHITNEY 1A, Motor Drive
SOCIETE GENEVOISE (SIPP) #4 Precision, Table 19"x27", Motor Drive

LATHES—Engine and Mfg.

AMERICAN 36"x300 centers, 2 carriages, motor drive
JONES & LAMSON "FAY" 20x25", Automatic, latest
JONES & LAMSON "FAY" 24"x24", Automatic, Latest
JONES & LAMSON "FAY" 24"x96" Centers, Geared Motor Drive
LeBLOND 21"x96" Centers, Geared Motor Drive
LODGE & SHIPLEY 18x72 centers, M.D.
LoSWING 4x90, 4x84, 8x60, 8x108, 5x34, Latest
MONARCH 10"x20" Centers, Model EE, Timken, Latest
MONARCH 10"x30" Centers, Model CKS, Timken, late
MONARCH 12"x30" Centers, Model CM, Timken
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CLEVELAND 12"x16" Centers, Cutter, Motor Drive
U.S. Tool #810B, 3"x15" Centers, Cutter, Latest

LATHES—Turret

BARDONS & OLIVER #5, 27, TIMKEN, Latest Type
GISHOLT #1L, #2L, Universal, Timken, Latest
GISHOLT #3, Univ., Timken, Latest Type
LIBBY "International" 1185 Univ., Timken, Latest
MOREY No. 2G, No. 3, No. 4 Timken Bearing, latest
POTTER & JOHNSTON #5DE, Timken, Latest
WARNER & SWASEY 3A Universal, M.D.
WARNER & SWASEY No. 5 Universal, Timken, latest

MILLING MACHINES—Mfg.

HALL Style L, Planetary, latest type
INGERSOLL 42"x36"x12" adj. rail, 4 heads, AC, M.D.
INGERSOLL 32x24x16" Planer Type 2 heads, AC, M.D.
INGERSOLL 20x264x12" adj. rail, slab, M.D.
SUNDSTRAND Model 2A Duplex 42" feed, Latest
SUNDSTRAND Model 2A Duplex Spiline, latest
TAYLOR & FENN M80 Duplex Spline, latest

MILLING MACHINES—Plain

BROWN & SHARPE #000, Timken, Latest Type
BROWN & SHARPE #2B, 3B, Timken, Latest Type
CINCINNATI 0-S, 1-12, 2-18 Automatic, Latest Type
CINCINNATI #3, #4, #5 High Power, Late Type
CINCINNATI 4-36, 24-36 Hydromatic, Timken, latest
CINCINNATI 4-36, 24-36 Hydromatic, Timken, latest
KEARNEY & TRECKER #2H, 4H, Latest
KEARNEY & TRECKER 1218, 1406, Simplex, Latest
KEARNEY & TRECKER 4K, Timken, Late
KEMPSMITH #4 Timken, Latest Type
KEARNEY & TRECKER 4K, Timken, Late

MILLING MACHINES—Thread

LEES BRADNER Model HT, 12"x54" Centers, Latest
MOREY 12x30", 60", 120", 180" centers, Latest Type
PRATT & WHITNEY 4½"x12" Model C, Latest Type
PRATT & WHITNEY 6x60" Model C, Latest Type

MILLING MACHINES—Universal

BROWN & SHARPE No. 2A Timken Bearing, Latest
BROWN & SHARPE No. 3A, 4A, Motor Drive
CINCINNATI #2MH, Timken, Latest Type
KEARNEY & TRECKER 2H, Timken, Latest Type
VAN NORMAN #3 duplex, Motor Drive

MILLING MACHINES—Vertical

BROWN & SHARPE #2 Standard Timken, Latest
CINCINNATI #2, Dial Type, High Speed, Latest
CINCINNATI #6S TIMKEN, Latest Type
CINCINNATI #6S Super-Speed, Latest Type
GORTON 8D, 8½D Super-Speed, Latest Type
MOREY 12M Single & Double Spindle Profiler, Latest
REED PRENTICE 3VU, with or without hydraulic duplicator, Timken bearing, Latest Type

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CINCINNATI 30"x30"x8' 4 heads, PRT, DC, M.D.
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DETRICK & HARVEY 48"x48"x16', 4 heads, Hydraulic Rapid Traverse, A.C. Motor Drive
NILES 108"x84"x42', 4 heads, Box Table, Rapid Traverse, D.C., M.D., Late Type
NILES 48"x48"x12' "Time Saver", Box Table, 3 heads, D.C. reversing motor, Latest Type
NILES 42"x42"x14' "Time Saver" Box Table, 3 Heads,
PRT, VARI-VOLTAGE Drive, Latest
NILES 96"x96"x24', 4 heads, Rapid Traverse, Box Table, D.C. reversing motor drive

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BIRDSBORO 325 ton, vert, hyd., Latest Type
BLISS 75-35 Hydro-Dynamic, Double Action, Latest
CLEARING K-1200-36 Knuckle Joint, 200 ton, 9" stroke, Latest Type
GLEASON 75", 25" Quenching, Hydraulic, M.D.
LAKE ERIE 500 ton Vert. Hyd., Latest Type

SCREW MACHINES—Automatic

CLEVELAND 9/16", 1-1/16" Model A, Latest Type

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AMERICAN 20" Heavy Duty, Motor Drive
CINCINNATI 20" High Speed, Latest Type
DILL 20"-24" Vertical, Motor Drive
LAMAIRE 18" Vertical, Hydraulic, Latest Type

SHEARS—Power

QUICKWORK #5, ¾" Cap. Rotary Shear, M.D.
QUICKWORK #6, 1" Cap., Rotary Shear, M.D.

MISCELLANEOUS

AJAX 2½" Forging and Upsetting, M.D.
BAKER #5 Keyseater Motor Drive
BARNES #172, 306H, 307, Vertical Hone, Hyd., Self Oiling, Latest Type
CAMPBELL, #401 Abrasive Saw, Latest Type
DE LAVAL #191 Coolant Clarifier, Latest
FOSTER 4"x18", 4"x30" Superfinisher, Latest
HELLER Model SS-1 Cold Saw, 6" cap., M.D.
LANDIS 2 Single Spdle. Bolt Threader, M.D.
NATIONAL 4" Forging and Upsetting, Latest type
NAZEL #4B Pneumatic Hammer, M.D.
PEERLESS 14"x14" Hydraulic Hack Saw
PRATT & WHITNEY (KELLER) Type BL-2416, Type G. Copying 2 and 3 dimensional, Latest Type

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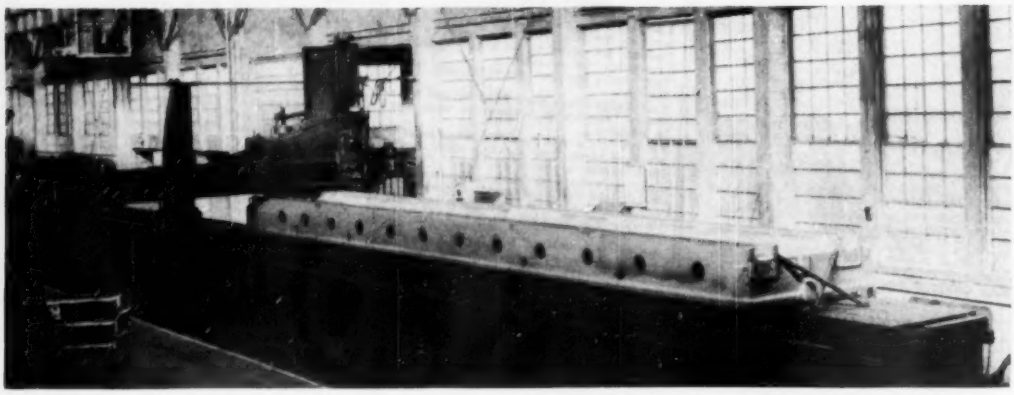

LIBERTY open side planer 12' cross rail x 40' table and 80' bed all in sections, outer movable rail support, 2 rail heads, 2 side heads, generator set, 35 H.P. motor direct drive, reversing. A.C. motor on rail. Rapid traverse box table. All gears in oil, forced feed lubrication to Vees. Factory rebuilt in 1940. Steel gibs on both sides of table to avoid lifting. Electric rail clamps. Available in December 1950. Can be seen in operation.

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2—BRYANT 24Lx36 and 24x36 deep hole internal grinders, 1942 models.
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FELLOWS model 61—36" gear shaper.
P&W 2 spindle profiler.
LENOX rotary bevel shear ⅞" cap.
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WICKES UH-4 double end crank shaft lathe.
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No. 30 RACINE Shear Cut Hyd. Hack Saw: NEW 1943, Cap. 10"x13"

MILLS
No. 5—50 HP CSM K. & T. PLAIN: 18"x94" tbl., NEW 1944, Serial No. 1-5136
No. 3K K. & T. UNIV.: 1500 RPM, NEW 1943
No. 4H K. & T., PLAIN: 1000 RPM, NEW 1942
No. 3K K. & T. PLAIN: 1500 RPM, NEW 1942
No. 3 CINCINNATI DIAL TYPE VERT.: 1300 RPM. NEW 1943, Serial No. 4A 3V1M-104
No. 36 VAN NORMAN DUPLEX PLAIN: Swivel Hd., NEW 1943 (2)
No. 12M MOREY 2 SPDLE. PROFILER: NEW 1943, Serial No. M-1694

TURRET LATHES
36" BULLARD VERT.: Fine Feed Attach., NEW 1942, Serial No. 19969
No. 5 GISHOLT RAM TYPE UNIV., Bar Feed, NEW 1943
No. 4 GISHOLT RAM TYPE UNIV., Bar Feed, NEW 1943 (2)
No. 5 MIDLAND RAM TYPE UNIV., Bar Feed, NEW 1943
No. 2G MOREY RAM TYPE: Bar Feed, NEW 1943 (2)

No. 2G BROWN & SHARPE AUTOMATIC SCREW MACHINE: NEW 1943

SHAPERS
28" ROCKFORD Standard Hyd. NEW 1945, Serial No. 69HE41
20" GOULD & EBERHARDT UNIV. TYPE TOOLROOM: NEW 1943 (2)
12" VERNON NEW 1943

GRINDERS
12"x36" NORTON HYD. CYL. UNIV., NEW 1943, Serial No. L1437
10"x48" NORTON TYPE "C" HYD. PLAIN CYL. NEW 1943, Serial No. 22652
72A3 & 72A5 HEALD INT.: HYD FEED, Cross Slide Hd, Raised Hd. & Spdle., NEW 1944
No. 33 EXCELLO EXTERNAL THREAD: NEW 1943, Serial No. 5191
No. 145 HAMMOND DBLE. END CARBIDE: NEW 1943

LATHES FLOOR
22"x96" c/c MONARCH: 16 Speed Grd. Hd., NEW 1946, Serial No. 28603
14"x54" MONARCH: 16 Speed Helical Grd. Hd. NEW 1945, Serial No. 28135
10" MODEL "EE" MONARCH TOOLROOM: NEW 1943 (6), Serial No. 23224 etc.

DRILLS
E5 NATCO MULT. SPDLE.: 14 Spdle., 2 Speed M.D. Hd., Serial No. E5-767
26" BUFFALO: All Grd. Sgle. Spdle.: No. 3 M.T. Power Feed

SPOT WELDERS
2—Type P2-36-RA FEDERAL UNI-PULSE: 1 Air Rocker, 1 Air Press Type NEW 1943
75 KVA FEDERAL: Air Operated Press Type, 440 Volt
75 KVA TAYLOR WINFIELD: Air Operated Press Type, 440V

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3—MODEL C CLASS WN-114 SULLIVAN: Radial Type; 14½x8¾"x7"; Coupled M.D. with 250 HP 440V synchronous mtr., with exciter, lubricator and control panel, inter cooler, after cooler, NEW 1943

PLATING EQUIPMENT
5000 AMP HANSON VAN WINKLE MUNNING PLATING GENERATOR 9 Volt, NEW 1943
2000 AMP HANSON VAN WINKLE MUNNING PLATING GENERATOR 3-40 Volts, NEW 1941, Serial No. 10951
1000 AMP CHANDEYSON PLATING GENERATOR, 40 Volts, NEW 1943
NUMEROUS HEATED TANKS, BLOWERS, CRANE

MISCELLANEOUS
No. 3 TORRINGTON Swaging Machine, NEW 1944
Model DS PARKER Tube Bender
No. 33 FEDERAL OBI Press
Grob Filer
ORTON Router
DE WALT Radial Saw
ROGERS Table Saw
OLIVER Tilting Arbor Saw
18' FARNHAM Fabricating Roll
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AUTOMATIC SCREW MACHINE. Acme-Gridley #6—⅞" Four Spdle. 5 h.p. 5 sets of collets. Tooling. Serial #15895. Excellent condition.
AUTOMATIC SCREW MACHINE. #2 Brown & Sharpe. Cap. 1". Collet, Collet Chuck, toolposts. Coolant System, etc. FOUR.
AUTOMATIC SCREW MACHINE. #2G Brown & Sharpe. Cap. 1". 2 h.p. 220/440 volts. Collet, Collet Chuck. Coolant System, etc. THREE.
BORING MILL. 61" Bullard MAXI-MILL. 2 Hds.
BORING MILL. #0 Giddings & Lewis. 3½" Bar. #5 M.T. 220-440 volts. TWO.
BORING MILL, Bullard 54" Vert. Spiral Drive.
BOREMATIC. Heald #48 Sgle. End. W/Univ. Fixture. 220/440 volts.
BROACH. Oliger 10 Tons Horiz. 59" Str.
BROACH. LaPointe #3B. 25,000# 56 Str. 2-spend
BUFFER & POLISHER. U. S. Electrical Multi-Speed Double End #85, 3 h.p., 220 volts, Four Speeds up to 2700 r.p.m. Floor model.
DRILL. Avey-Matic #3 Hvy. 2-Spdl. #3 M.T. 36". 15" C.C.
DRILL, Cincinnati 21" Bgrd. Drilling & Tapping.
DRILL, Radial. Cinci-Bick. 5' Arm, 13" Col. #3 M.T. 24 speed geareds. 7½ h.p. 440/220.
DRILL. L. Gilfords #2MB 14". 11" C.C. 3-Spdle
DRILL, Baker #314 Hvy. Pattern High Speed Vertical Boring & Drilling Machine, 7½ h.p. 220/440 motor, #5 taper, 12 feeds, 8 speeds, 12½" thrust. 3" Capacity in steel.
DRILL, Leland Gifford #2LMB Upright Sliding Head Two Spindle, #2 taper, 13" overhang. Independent 220 volts. 4-speed motors, indicated spindle speeds.
DRILL, Natco #12 Multiple Spindle Motor Driven, #1 taper, 3 h.p. 220/440 motor. Arranged for 18 spindles. Rectangular head. With Natco 24" Rotary Table.
STRAIGHT BEVEL GEAR GENERATOR 3" Gleason. Serial #18894. NEW—1942. 220/440 volts motors. Gear Cabinet, Full Set of Index Gears. Segments, Auto-Index Attachment. Pneumatic Chuck Equipment. Cutter Setting Gauges & Segment Setting Gauges, Duplete Cutting Cam & Duplete Feed Cam.

PARTIAL LISTING OF LARGEST STOCK IN THIS AREA

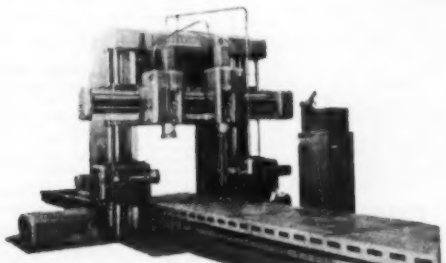
BASE PITCH & SPACE MEASURING MACHINE. #337 Illinois. Late Type—Like New. Capacity—12" diameter gear, 12" between centers. Full Set of 60-Set and Straight Contact Fingers, Dial Indicator, Tailstocks and Leatherette Cover.
THREAD GRINDER, J & Lamson #TG-615 Automatic, Late Type
GRINDER, Blanchard #16, 20" Chuck Vert Rotary.
GRINDER, Landis Crank 10x32 Hydraulic.
GRINDER, Brown & Sharpe #2 Auto. Horiz. Surface.
GRINDER, Cincinnati #6A, 10" x 36" Hydraulic Cylindrical, Filmatic Bearings, 220 volts motors. Built-in electrics, Hydraulic infeed.
GRINDER, Covel #76, 8x24 Hydraulic Horiz. Surface.
GRINDER, Norton 6x18 Hydraulic Vert. Rotary Auto. Exzello Spdle.
GRINDER, Norton 6x18 Hydraulic Horiz. Surface. Exzello Spdl.
GRINDER, Pratt Whitney 22" Vert. Rotary. 84" table travel.
GRINDER, Reid #2-B All-Electric 0x18 Auto. Horiz.
GRINDER, Thompson 0x18 Hydraulic Horiz.
GRINDER, Bath 10"x25" Motor Driven Universal Surface, 220/440 volts motor with centralized push button controls, Internal Grinder Attachment & Steady Rest, etc.
KEYSEATER, Mitts & Merrill #5 Giant Motor Driven, 220/440 volts motor, Capacity—24" long, 3" wide keyway, Automatic Feed.
LATHE, American 27"x10' Grd. Hd. 12 speed. Taper Attach. & Chuck.
LATHE, LoBlond 30" x 30'. 220/440 motor. 12 speed head, taper attachment, steady rests, etc.
LATHE, Bridgeford 20"x14' Q.C.G. 8'5" C.C. 220 volts two speed motor.
LATHE, Hardinge #50 High Speed Second Operation Machine, 1" Collet Cap. Automatic Collet Mechanism, collets, collet chucks, etc. FOUR.

TURRET LATHE, Bardons & Oliver #7 Universal Grd. Hd. Ram Type. Hydraulic Spood Selector, 2½" Cap. 10 h.p. 220/440 motor. With Chuck, toolholders, etc.
MILLING MACHINE, Van Norman #3SP Horiz. 54x12x18. Late Type.
MILLING MACHINE, Cincinnati Vertical #3 H.S. Dial Type. W Rotary Table.
MILLING MACHINE, U. S. #MMI-6 Cam Controlled Automatic Horizontal, #40 taper. Late Type. 220/440 ...otors. TWO.
MILLING MACHINE, Van Norman #3V Ram Type Vertical, Late Type. 220/440 motors. Also stub arbors, arbor, vise, collets & cutters.
TURRET LATHE, W & S #4 Univ. Grd. Hd. 12 speed. Bar Feed W/tooling.
O.B.I. PRESS, Bliss #21B. 40 tons. 2½" Stroke.
O.B.I. PRESS, Bliss-Con. #3½, 42 tons. 4" Stro.
POWER PRESS, Bliss #166 Open Back S.S.S.A. 65 tons. 4" Stro
POWER PRESS, Bliss #38 Reducing. 17 tons. 8" Stro.
POWER PRESS, Bliss #84 S.S.S.A. 88 tons. 10" Stroke. 20" between uprights.
POWER PRESS, Bliss #75½ S.S.S.A. 120 tons. 5½" Stroke. 24" between uprights.
POWER PRESS, Bliss #3A S.S. Dble. Crank S.A. Grd. 45 tons. 4" stroke. 20" between uprights.
WHEEL PRESS, Niles B & Pond 200 Tons Hydraulic Horizontal, 48" between strain bars, Two Plunger Type, 7.5 h.p. 220/440 motor.
POWER PRESS, Bliss-Consolidated #77 Open Back Gap Frame Sgle. Crank Sgle. Action Back geared. 175 tons, 10" stroke, Bed area—24" x 42", With Roll Feed and Roll Straightener.
POWER PRESS Ferracute #88 Double Crank Sgle. Action, S.S. Geared, 80 tons, 1½" stroke, Bed area —61½" x 27½"
POWER PRESS — Bliss - Consolidated #183 - B Straight Side Dble. Crank Single Action, 45 tons. 6" stroke, Bed area—24" x 41", 10 h.p. 220 motor.
SHEAR, Gap Squaring, Niagara #912BB, 10'2½" Overdrive, 15" Gap. 20 h.p. motor, 220 V. spring hold-down and extra blades.

GUARANTEED TOOLS

16"x60" **PRATT & WHITNEY** Toolroom Lathe
18"x90" **CINCINNATI** Lathe, Taper, 1942
20"/40"x14' **RAHN LARMON** Geared Head Sliding Bed Gap Lathe
24"x24' **LODGE & SHIPLEY** Lathe, 18" centers
No 4A **WARNER & SWASEY** Turret Lathe, Full length leadscrew, tooling, New 1942
Model R-14 **SENECA FALLS** "Lo-Swing" Lathe, 16"x40", automatic timing, 1941
No. 12 **BROWN & SHARPE** Automatic Milling Machine, 1942
No. 2 **CINCINNATI** Dial Type Vertical Mill, power downfeed, rotary table, 1942
No. 3 **CINCINNATI** Dial Type Plain Mill, Vertical Head, 1941
No. 4 **REED PRENTICE** Vertical Mill and Die Sinker, rotary table, 1942
No. 1-18 **CINCINNATI** Plain Mill, 1942
No. 33 **STOKERUNIT** Production Mill, 1942
4" **TAYLOR & FENN** Duplex Spline Mill, 1942
4'13" **CARLTON** Ball Bearing Radial Drill
4' **FOOTE-BURT HAMMOND** Jackknife Radial Drill with electric tapping attach., 1942
No. 31 **LUCAS** "Precision" Table Type Horizontal Boring Mill, 3" bar
42" **BULLARD** New Era Type Vertical Turret Lathe, side head, AC motor
94" **CONSOLIDATED COLBURN** Vertical Boring Mill, 2 swivel heads, rapid traverse, AC—MD
No. 5 **GALLMEYER & LIVINGSTON** 12"x36" Surface Grinder
No. 3 **BROWN & SHARPE** Universal Grinder. Internal attach., 1941

O'CONNELL MACHINERY CO.
1875 NIAGARA ST. BUFFALO 7, N.Y.



72"x72"x30' Ingersoll Adjustable Rail Planer Type Miller, with two rail heads and two side heads. Table feed range IPM ¾" to 36", Saddle feeds IPM ⅜" to 18", Length of bed ways 60'. Approximate weight 160,000 Lbs., Inspect at Albany.

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(Late—New Since 1935)
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AUTOMATICS

Gosa & DeLeeuw 7½" 6-Spindle, Latest
(2) National Acme 1⅝" R.S Spindle, Late
Nat'l Acme 3¼" Model "L" S.S.
New Britain #16 Automatic, Late
(3) New Britain #61 1⅝" Automatic, Latest

BORING MILLS

Bement 41½" Table Type Horiz.
Cincinnati 44" Vertical Boring Mill
Giddings & Lewis #45 Horiz. Table Type
Niles 100" Vertical Boring Mill

DRILLS & RADIALS

Avey #3 S.S. Drill Press, Latest
Allen 6-Spindle Drill Press, Latest
Carlton 5'13" Radial Drill

GRINDERS

Arter A 1—12" Rotary Surface Grinder, Latest
Brown & Sharpe #22—10"x36" Cyl. Gr., Late
Bryant #5 Chucking Grinder, Late
Cincinnati 12x36" Univ. Cyl. Grinder
Cincinnati 12"36" Universal Grinder
Ex-Cell-O #31 Plain Thread Grinder, Late
(3) Fitchburg 10"x18" Angular Head Grds., Late
Heald #22—12" Rotary Surface Grinder, Late
Heald #72A Internal Grinders, Late
Heald #81 Gagematic—Sizematic Gr., Late
Jones & Lamson 6"x36" Thread Grinder, Late
Landis 6"x30" Type C Plain Grinder, Late
Lebedeff 32"x15" B.C. Roll Grinder
Norton 10"x36"—45° Cylindrical Gr.
Van Norman 20"x48" Crankshaft Re-Grinder, Late

LATHES

American 24"x9' Engine Lathe
Betts-Bridgeford 36"x8' B.C. Lathe, Late
Gisholt #3 Turret Lathe, Latest
Gisholt #4L Turret Lathe
Hendey 24"x72" B.C. Lathe, Late
LeBlond 21"x7' Engine Lathe
Lodge & Shipley #3A Duomatic Lathe, Late
Merry 1" Turret Lathe, Bar Feed
Monarch 20"x48" Engine Lathe, Late
Reed-Prentice 14"x30" (6' Bed) Late, Late
Wickes 36"x16' Bed Engine Lathe

MILLS

Brown & Sharpe #3A Univ. Horiz. Mill
Brown & Sharpe #3 Horizontal Mill
Cincinnati #4 Vert. Hi-Power Mill
Cincinnati #1-18 Mill, Late
Cincinnati #3-24 Hydromatic Mill, Late
Cincinnati 24" Duplex Mill, Late
Kearney & Trecker #2C—44" Heavy Geared Blanking Press
Kearney & Trecker #1H Horiz. Mill, Late
Kearney & Trecker #3K Horiz. Mill, Late
Lees-Bradner 12"x36" Thread Mill, Late

PRESSES

Farracute 100 Ton S.S. Punch Press
H.P.M. 100 & 150 Ton Hydraulic Presses, Late
Minster 100-4-60, 32"x60" Power Screw
Toledo #59—⅝ Punch Press
Toledo #82C—44" Heavy Geared Blanking Press
Toledo #95-B-54" Geared Dbl. P. Press
V & O 31½" (35 Ton) Press, Late

MISCELLANEOUS

Bakewell #1 Tapping Machine, Late
Cincinnati 36"x36"x16" Hypro Planer
Cincinnati D.H. Planer 36"x36"x20'
Cincinnati Planer 48"x36"x18'
Cincinnati 2-48 Hydro Duplex Vert. Broach, Latest
Cochrane-Bly #55 Cold Saw, Late
Detroit Tap Grinder, Late
Do-All V16 Band Saw, Late
Manville 150-Ton Header, Latest
Marvel #18 Hydraulic Saw, Late
Niles 90° Quartering Machine
Pond D.H. Planer 60"x72"x18'
50 KW 3-Station Tocco Unit, Latest

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4537 St. Clair Ave.
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LATHES

Niles-Bement-Pond 48"x30' centers—quick change Gr.—Gr. Hd., Heavy Duty, A.C. Motor Drive—2 carriages—taper attachment—power rpd. traverse—16 spds. 2.04 to 90 RPM—late type.
Monarch 20"x72" centers model "M", 16 spd. gr. hd. 22½" swing, Monarch auto. sizing controls (late).
Pratt & Whitney Model "B" 16"x36" motor-in-base Bridgeford 36"x56', 15 spd. gr. hd. 38" swing 48" C.D. mtrzd. carriage.
Lodge & Shipley 24"x21' Ctrs. 12-Speed Geared Head, MD—with two carriages.
American 16"x8', 12-Speed GH Motor-in-base High Duty Engine Lathe with TA, Swing 18½", Centers 31".
Bekamarker & Boye 30"x12' QCG DBG MD—Swing 37¼", Centers 66", with Taper Attchmt. extra tool block.

TURRET LATHES

Gisholt No. 5 Ram Type Pre-Selector head Universal, Late, hole through spindle 2-25/32", swing 19¾", max. turning length 27", bar feed, chucking, tooling.
Jones & Lamson No. 7A Saddle Type Hollow Hex. Universal, Late hole through spindle 3", swing 21¼", max. turning length 36⅞", chucking, threading, tooling.
Warner & Swasey No. 3A Heavy Duty Saddle Type Hollow Hex Universal, hole through spindle 4⅝", swing 24½", max. turning length 44¼", bar feed, chucking, quantity of tooling.
Warner & Swasey #4 Pre-Selector Hd Universal, Swing 18½", max. turning length 29", bar feed & chucking—tooling (late).

BORING MILLS

Universal 4" bar "Tri-Way", face plate to outer support 72", #6 taper, added vertical range (late).
Fisher 5" floor type, vert. travel Hd. 60" hor. travel col. 110", platen (very late).
Lucas #33, 4½" bar, face plate to outer support 84", #6 Morse taper, A.C. motor drive.
Bullard 24" and 36" "Spiral Drive" 24", 30" & 42" "New Era" type, vert. 3-jaw and 4-jaw chuck tables.

RADIAL DRILLS

Fosdick 5'17" motor-on-arm "Economax" hydr. #6 taper, very late.
American 4'8" Col. "Hole Wizard" (late type) 70 to 2100 RPM.

PRESSES

Toledo #59, 255 ton, S.S. dbl. gr., 4 pc. tiered constr. 18" stroke, bed area 36¼"x35", net wt. 55,000 lbs.
Cleveland #24A, M.D. horning and wiring 3½" stroke, nt. wt. 2000#.
Standard 4R Motor Driven Reducing S.S., 12" stroke Bed area 18¼"x17½", nt. wt. 4900#.

AUTOMATIC SCREW & CHUCKING MACHINES

Brown & Sharpe #4, 1½" cap. motor-in-base, auto., collets, change gears, and tooling.
Potter & Johnston #5D Auto. chucking and turning (late type), 5 face turret, 25" swing, air chuck, quantity of tooling.
Potter & Johnston #6 DRE chucking and turning, swing 34", Timken bearings, 5 face turret.

Complete Your Machine Tool Files
Send For Complete Listings

Botwinik Brothers

12"x102" Model HT Lees Bradner Thread Milling Machine, 1943

10"x60" Pratt & Whitney Thread Milling Machine, Late Type

No. 72-A-5 Heald Universal Internal Grinder, Cross Sliding Head

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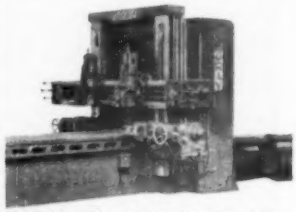

48"x48"x12' GRAY PLANER: NEW 1941 4 Heads, M.D.
10"x48" NORTON TYPE "C" HYD. CYL. GRINDER: NEW 1941, M.D.
24"x30"x72" MATTISON HYD. SURFACE GRINDER: M.D.
14"x48" MATTISON HYD. SURFACE GRINDER: M.D.
12"x16"x60" MATTISON HYD SURFACE GRINDER
32"x144" c/c SPRINGFIELD GEARED HEAD LATHE: NEW 1949, T.A., M.D.
36" ROGERS VERTICAL BORING MILL: Side Head, M.D., NEW 1943

Only Partial Listing—
Over 2,000 Machines in Stock

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AUTOMATICS, ETC.

16"x36" Sebastian geared head lathe, new '43 guaranteed excellent $1200
Blount Lathe 16"x36" 4-sp. late type $ 450
Centerless #4, #2 Cin. 25 HP direct connected motor drive $1250 and $1850
Acme ⅞" 4-sp. Mod. R, Tooling $1850
Conomatic 15/8" 8-sp. late type $8900
Cleveland Mod. A2", B1¼" $975 & $450
B&S #00, #0, #2 Hi-sp. Turner Dr. $1250
Bliss Presses 304, #6, 64 and dial type V & O & Bliss Trimmers $250 up
Toledo 50 Ton #92-B 4" Stroke $1850
#3 Cin. Uni-Miller, vertical head, feed power all around, excellent $1950

EVEREADY, E. J. McCallum, Pres. 4-9471
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BOREMATICS—Heald #48A and #49
GRINDER—Blanchard #11 Rotary Surface, Excl.
GRINDER—Heald #72AS Sizematic, Like New
THREAD GRINDER—J & L 6"x3" Internal
THREAD MILLER—Hanson Whitney 8"x16"

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2 Allen 4 Spindle Type KH Drills $1,500.00 Ea.
1 Allen 6 Spindle Type KH Drill $2,250.00
Hand Feed, #2 MT, ⅝" Drilling Capacity.
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48"x26' c.c. American "Super Productive," lathes, 2.
10"x20" Monarch EE lathe, taper, collets, '41.
36" Rogers Vert. Turret Lathe, '42.
10"x24" Landis Univ. Grinder, type C, '42.
#34 Abrasive Vert. Surface Grinder, late.
6"x18" Norton Surface Grinder, late.
3" Gleason bevel gr. generator, '42.
#75A Fellows gearshaper, '41.
#2MH Cincinnati Plain Mill, 1941.

36"x36"x14' CINCINNATI "HYDRO" PLANER

#2A Brown and Sharpe Univ. Mill, Timken, M. in base.
16" Gould and Eberhardt Univ. Shaper, 1941.
2—16" x 10' Ledge and Shipley lathes, taper, M. in base.
#45 Giddings and Lewis 4½" horiz. mill.
3" Universal horiz. boring mill.
#2MS Leland Gifford 3 spdle. drill.
2—6" Oster "Rapiduction" pipe threaders, M.D.

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UNUSUAL VALUES

Milling Machines—No. 1 Universal, No. 1 American (new) plain, No. 1 Vertical.

Drills—Large selection, single and multiple spindles also bench types, many of them new.

Gear Cutters—Brown & Sharpe No. 9—26" Gould & Eberhardt 42".

Grinders—Cylindrical B & S No. 11, Planer type 16"x36" Surface 12"x32", also new (small) Universal bench and floor type. All with coolant, motorized.

Lathes—14"x8', 6', 10'—16"x8', 8', 10'—18"x8', 8', 10'—26"x16'—all cone drive, several motorized also (new) 18"x8' and 10' geared head, motorized.
Large stock 19" and 16" bench and floor type.

Planers—Single head 24"x8', 24"x8', 26"x8'.

Shapers—10", 20", 24" B.G. crank.

Turret Lathes—J & L 2"x24"—3"x36" also Acme. W & S Turret (vertical) boring and facing mills, 5 hole turrets, 30", 40".

SPECIAL—New totally enclosed dust proof, fan cooled ball bearing saw arbor motors, plain shafts to size or threaded, and with collars, measures only 5¼" from center of shaft to flatted top (1 h.p. to 15 h.p.) 2 or 3 phase, 3600 r.p.m.

WOOD WORKING MACHINERY—A very large stock of new and re-built, practically all motorized. New Motorized overhead cut-off and miter saw for wood, plastics, steel, aluminum and other metals. The above list is only a fraction of our stock which changes almost daily, therefore, tell us definitely what you want since we are adding considerable number of machines to our stock which are too many to list. What we have today may be sold tomorrow, so a list is really not dependable.

Drill—Foote-Burt No. 25 24" HI Duty 3" capacity in steel. Motor attached.

PATTERN MAKING MACHINERY—42"x16' bed wood lathe, compound rest, rack and pinion feed to carriage; 16" heavy duty jointer, extra long bed, front table tilts for giving draft to pattern work; tilting table also tilting arbor rip and cut-off saws; band saws; jointer; floor and bench type trimmers; and also many other machines for pattern work.

THE OSBORNE & SEXTON MACHINERY CO.

P. O. Box 88 Columbus 16, Ohio

LATE MODEL MACHINE TOOLS . .

AUTOMATICS

No. 40 New Britain Chucker, 1941.
No. 12"x21" Fay Automatic, 1942.

BOLT MACHINES

No. 500C Manville Thread Roller. Latest.
No. 250C Manville Header, 8SSD. Latest.

BORING MACHINES

62" King Vertical, 1942.
48 & 49 Heald Single End, 1942.

DRILLS

4"115" Canedy-Otto, 1942.
6"15" American Hole Wizard, 1941.
No. 26HO Baker, 1942.

GEAR EQUIPMENT

12" Gleason St. Bevel Gen. 1942.
No. 6 Gleason Ravacycle, 1941.
No. 6 & 17 Gleason Testers, 1943.
8" Red Ring Internal Shaver, Late.
No. GCI, Red Ring Shaver, 1942.
No. 61SA2, 61TA & 81A Fellows, 1944.
No. 72 Fellows Shaper, 1945.
Red Ring Univ. Checker.

GRINDERS, CYLINDRICAL

25"x10" Landis Crankshaft, Like New.
16"x36" Cincinnati Plain, 1942.
12"x30" Landis Univ. 1941.
10"x72" Landis Plain, 1942.
10"x18" Norton Plain, 1942.

GRINDERS, SURFACE

10"x26"x192" Mattison, 1943.
14"x36" Pratt Whitney, 1943.

GRINDERS, INTERNAL

No. 24-30 Bryant Hyd. 1941.
No. 172 HEALD Gap, 1940.
No. 72A3 & A5 Heald Rotary, 1943.
No. 73 Heald Hydraulic, 1942.

LATHES, ENGINE

27"x96" LeBlond, 1942.
16"x54" Reed-Prentice, 1942.
14"x30" Bradford, 1942.

LATHES, PRODUCTION

No. 3A L&S "Toomatic", 1943.
8"x108" Lo-Swing Semi. Auto. 1942.
Model 10 Sundstrand, 1942.
14"x42" Monarch "Magna-Matic", 1941.

LATHES, TURRET

36" Bullard Vertical, 1942.
No. 3A Warner & Swasey, 1941.
No. 4A Warner & Swasey, M.D.
No. 1 & 3½"x24" Acme Univ. 1943.
No. 3H Gisholt, 1942.
No. 3H Libby, Late.
No. 6R Denver, 1942.

MILLS, PLAIN

No. 3H Brown & Sharpe, 1941.
No. 2S Van Norman, 1942.
No 2 Cincinnati, 1940.

MILLS, PRODUCTION

No. 1 14 & 2-20 Kent Owens, 1942.
No. 1234 Kearney & Trecker, 1942.
No. 3-36 Cincinnati Duplex, B. & F. 1942.
No. 1-18, 2-18 & 2-24 Cincinnati, 1942.

MILLS, THREAD

10"x54" Lees Bradner, 1942.
6"x36" Lees Bradner, 1942.

MILLS, UNIVERSAL

No. 2MH Cincinnati, 1942.
No. 2H Milwaukee, 1942.

MILLS, VERTICAL

No 2H Milwaukee, 1942.
No. 2 Cincinnati, 1942.
No. 1 Cleveland, 1942.

PRESSES

50 Ton Denison, Hyd., Str. 1942.

WELDERS

150 KVA Federal Seam, 1943.
60 KVA Federal Spot, New.

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1-1/6" Cleveland Model M.
1⅞" Conomatic 8 spindle.
2"x18" Cleveland Model B.
4¾" Conomatic 4 spindle.
No. 454 New Britain 4 spindle chucker.
8" Bullard Multomatic 6 station.
14"x18" Monarch Mag-na-Matic.
14"x19" Fay.
1" Economy hopper feed shaver.

BORING MACHINES

100" Niles-Bement-Pond vertical, extra heavy.
52" King vertical.
36" Bullard vertical turret lathe.
5" Jones floor planes type horizontal.
4½" No. 33 Lucas horizontal.
3¼", No. 32 Lucas horizontal.
3" No. 3A Universal horizontal.
Nos. 47A & 48A Heald Borematics.
No. 42 Heald Borematic.
No. 112 B Ex-Cell-O.
No. DB 2112 Ex-Cell-O.
No. 1212A Ex-Cell-O 4 spindle.
Vernon vertical miller or jig borer.
Munson double end horizontal.
No. 4 HH Baker 2 way horizontal.

ENGINE LATHES

14"x6' Lodge & Shipley
16"x5' Sebastian
16"x10' American.
18"x6' Lodge & Shipley.
18"x8' Rockford.
20"x8' Lodge & Shipley
25"x48" centers LeBlond.
30"x16' LeBlond.
36"x16' Bridgeford.
40"x15' LeBlond heavy duty.

TURRET LATHES

Nos. 2, 1A & 3A Warner & Swasey
No. 7 Bardons & Oliver.
Nos. 3AL & 28" Gisholt.
No. 4 Midland.
24" & 36" Bullard vertical.
3"x36" & 4"x34" Jones & Lamson.
Nos. 2G Morey.
No. 5 Foster.

MILLERS

No. 2H Kearney & Trecker universal.
No. 3 Cincinnati universal.
No. 3 Van Norman Duplex.
Nos. 2AS & 3B Milwaukee plain.
No. 3 Cincinnati MSDT plain.
No. 3 Ohio plain.
Nos. 2H & 3H Kearney Trecker vertical.
Nos. 2, 3 & 4 Cincinnati dial vertical.
No. 3V Van Norman vertical.
No. 3 Kempsmith Maximill vert.
No. 4 Cincinnati H.P. vertical.
Cincinnati Nos. 08, 1-12, 1-18, 2-18 & 2-24 automatic
Cincinnati Nos. 3-24, 3-36, 34-36, 4-36, 4-48, 5-48, 56-72 & 56-90 Hydromatic
Cincinnati No. 34-36 duplex Hydromatic
Cincinnati Nos. 08 & 2-18 Rise & Fall
K.&T. Nos. 1H-12", M18, M24 & 12-24

SHAPERS & PLANERS

16", 20", 24" & 28" G&E shapers.
20" x 24" Gemco univ. shapers.
24" Columbia univ. shapers.
30"x24"x6' Liberty openside planer.

MISCELLANEOUS

BALER, No. 23P-60 Logeman hydraulic.
BROACH, 10T, 36" stroke Colonial surf.
BROACH, 15T, 42" stroke, V3 Lapointe
DRILLS, 121, 217, 314A, 315, 30H Baker.
GEAR HOBBERS, 8H, 12H, 16HS, 18H G&E.
GRINDER, 12"x36" Cincinnati univ.
GRINDER, Internal, No. 24-36 Bryant
GRINDER, No. 24 Abrasive surface.
HAMMER, No. 5N Nazel air.
HONER, No. 307 Barnes.
LAPPER, No. 26F Norton Hyprolap.
PROFILER, No. 12B Pratt & Whitney.
PRESS, 1000 ton Bliss coining.
PRESS, 600 ton Hamilton forging.
PRESS, 1000 ton Baldwin hydraulic
PRESS, No. 61 Cleveland OBI
SHEAR, 72"x14 ga. Wysong & Miles
TAPPER, Baush radial arm.
TAPPER, No. 1 Bakewell.
UPSETTER, 2" National, 4" Ajax
WELDER, 200 KVA Federal flash.

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No. ½B P&W Two Spindle Reaming Machine.

Model W-7 BAUSH Hydraulic Multiple Spindle Drills.

20" G&E Industrial Shaper.

No. 4 W&S Ram Type Universal Turret Lathe.

No. 5 JONES & LAMSON Ram Type Universal Turret Lathes

No. 3B B&S Dual Control Plain Miller

No. 145 CLEVELAND Rigid Hobber

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36" & 42" King Side Hd. Vert. Bor. Mills, '43
6'17" col. Carlton Radial, New 1943
No. 3 Cinci. Dial Vert. Miller, Late
No. 4B B. & S. Plain Miller, Late
No. 36 Van Norman Pl. Miller, Ram, '43
No. 2 Stand. K. & T. Univ. Miller, Timken
No. 2 Stand. K. & T. Plain Miller, Timken
No. 2LU Van Norman Univ. Miller, '42
Barnes Combn. Boring & Honing Mach., up to 10" bore x 8" hole, 1942
30"x120" Hanchett Plano Surface Grinder
12"x30" cen. Pratt Whitney Tool Room La., '43
14"/16¾"x30" cen. L. & S. Lathe, T.A., '43
14"/16½"x54" cen. Bradford La., T.A., near new.
30"x20' cen. Axelson La., T.A., 34" swing
16" Gemco Univ. Shaper, '43, near new.
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No. 2G Morey Univ. Turret La., New
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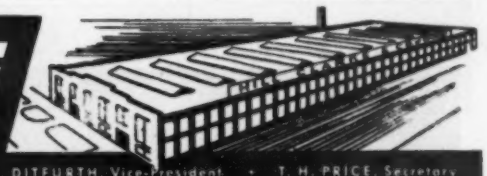

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1, 2, 3, 4, 5, 6 Spdls Leland-Gif.. Allen, Edlund, Avey's
No. 4BL Natco 36 Spdl. (1943)
No. 150 Baker
No. 112 Defiance
4'-15" Col. American Hole Wizard

GEAR MACHINES
No. 61-A Fellows Gear Shaper (1942)
No. 71-A Fellows Gear Shaper (1942)
No. 7125 Fellows (1943)
No. 72 Fellows Gear Shaper
No. 5A Lees-Bradner Gear Generator
No. 12 Gleason Bevel Gear Generator
No. 5—60" Brown & Sharpe Gear Cutter
No. 13 Brown & Sharpe
No. 3 Barber-Colman Hob Sharpener

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No. 31 Lucas 3" bar, M.D.
Rockford—3½" Bar
No. 32 Gidcings & Lewis 3½" Bar
No. 2 Lambert 4" bar
No. 46-B Heald Bore-Matic (1942)
No. 112—C Excello 2 Spdl. (1942)
24" Bullard New Era
36" Bullard New Era
42" Bullard New Era
42" King
60" Colburn, M.D.
72" Niles-Bement-Pond
84" Betts, M.D.

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3"x12" Brown & Sharpe No. 5 (1944)
4"x12" & 4"x18" Landis, Model H (1942)
6"x18" & 6"x30" Norton Type C Plain (1943)
10"-14"x36" Norton Type C Plain (1942)
10"x18" Norton Type C Plain (1943)
10"x48" Norton Type C Plain (1943)
10"x72" Landis Type O Hydraulic
Norton Motorized Grinders ranging from 6"x18" to 24"x144"
12"x36" Cincinnati Universal (1945)
No. 5 Bryant Internal Grinder
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No. 34 Abrasive Surface Grinder (1943)
16" Arter Rotary Surface Grinder
No. 25-A Heald Surface Grinder
No. 72-A-3 Heald Internal (1942)
No. 72-A-5 Heald Internal (1942)
No. 16—38 Bryant Internal Gdr.
No. 81 Heald Pl. Centerless

LATHES
18"x6' American, Gdr. Head, M.D.
18"x8' American Gd. Had.
18"x8' Cincinnati, M.D.
24"-27"x22' Lodge & Shipley
36"x16" Betts—Bridgeford Grd. Head
10"x22" Sundstrand, Model AA (1943)
20" Fay Automatics (1942)
Model R-14 Seneca Falls Lo-Swing
No. 4 Warner & Swasey, Bar Feed
No. 4 Gisholt Univ. Turret Lathe (1942)
No. 4R Libby (1942)
No. 6 Warner & Swasey, Bar Feed
No. 1A Warner & Swasey, Bar Fd.
No. 4F Fastermatic (1942)

MILLING MACHINES
No. 3B Milwaukee Plain
No. 4 & No. 5 Cincinnati H.P. Plain
No. 3 Cincinnati Universal
No. 0B Cincinnati Vert.
No. 2½-B Milwaukee Vert.
No. 2 Cincinnati Dial Type Vertical (1941)
No. 3 Cincinnati H.P. Vertical
No. 1-1B Cincinnati H.P. Vertical
No. 1-1B Cincinnati Mfg. (1942)
No. 2—18" Sundstrand-Electromill (1942)
No. 3-24 Cincinnati Hydromatic (1942)
No. 4-48 Cincinnati Hyd. Tracer (1942)
No. 43-48 Cin. Hyd. Tracer (1941)
No. 36-72 Cincinnati Hydromatic
6"x36" Lees-Bradner—Model LT (1943)
10"x48" Hanson-Whitney Thread (1942)
48"x24"x12' Ingersoll Slab Miller
36"x24"x12' Ingersoll Duplex Miller (1946)
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Model 2L Gisholt 16" turret lathe
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No. 40-5 Minster S.S.—D.B.G. Press, 16" stroke.
No. 5 Loshbough Jordan B.G.—O.B.I. Punch Press, M.D., 4½" stroke.
No. 3¾ Bliss S.S. Toggle Press.
No. 6 Bliss S.S. Tie Rod Press.
No. 174 Toledo Tie Rod Toggle Press.
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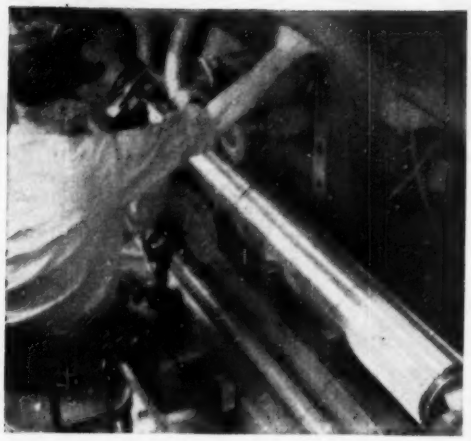

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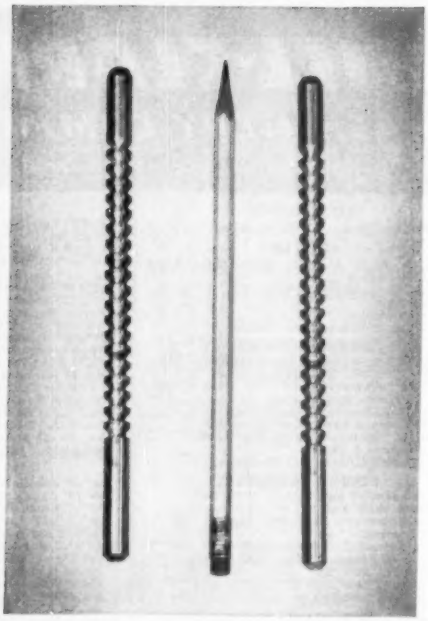

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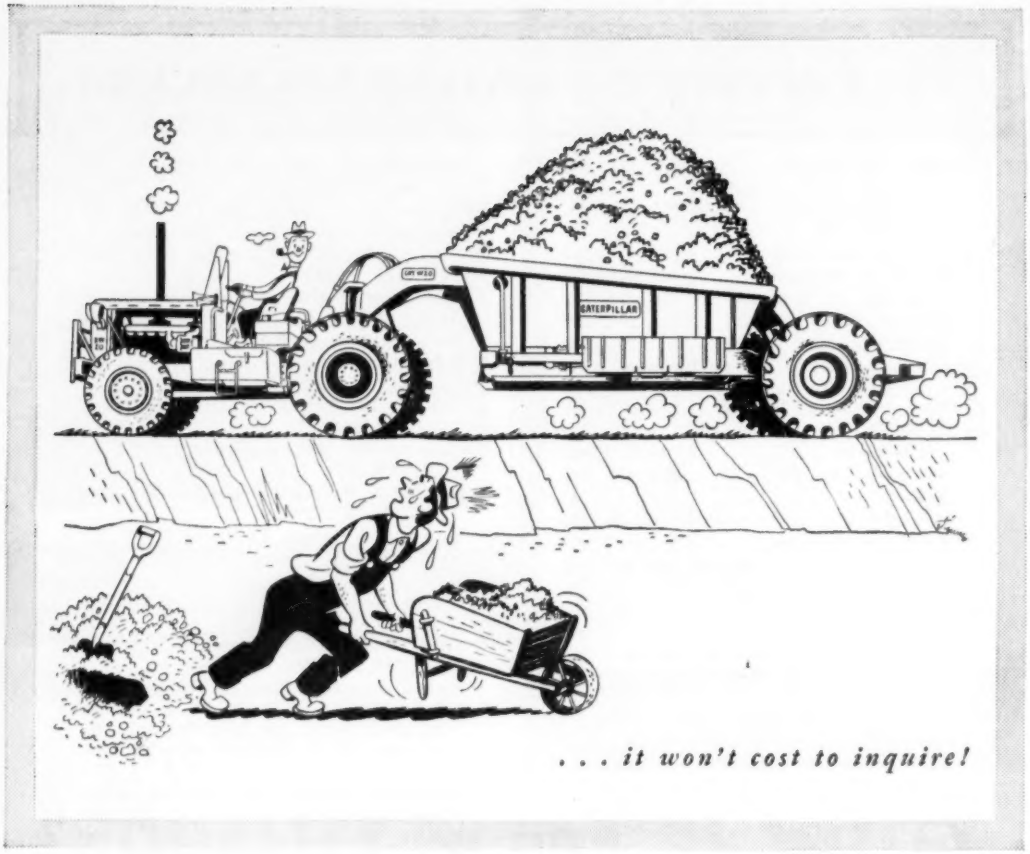

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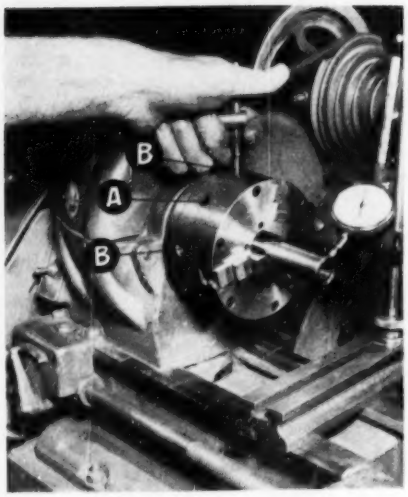
First Chuck Advance in 50 YEARS!!!



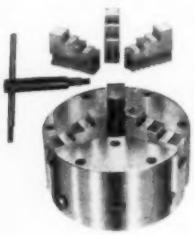
HOW THEY WORK

Pinion "A" moves jaws in or out to grip work like any scroll chuck. 4 opposed screws "B" bring the work to dead center. It's as easy as it sounds. (Men who have never used chucks before have centered work within .0005 in 3 minutes.) Once set dead true the same machining on duplicate parts (from two to hundreds) can be done without changing adjustment!

Buck AJUST-TRU CHUCKS

1. **.0005 Precision with scroll chuck speed!**
2. **Collet and Step-Collet functions at scroll chuck cost!**
3. **New 6 Jaw chucks end most needs for Stub Arbors and Mandrels!**
4. **Compensate for spindle run-out to lengthen useful life of old machines!**

Right at a time when the big push for production is on comes this revolutionary new idea in chucks to help win the battle. Here—at ordinary scroll chuck prices—are chucks that give you the precision of 4 Jaw chucks plus spindle collet capacity of ⅛" to 1½" by .001 *plus* step collet capacity of ⅛" to 5" (on 6" chucks) by .001. Think of the hundreds of dollars to be saved on machinists time, on collets, on stub arbors, mandrels, and special fixtures. But that is only part of the great news. Write today for illustrated literature with complete details.



3 STEP-JAW CHUCK

Now you can get .0005 precision on a 3 jaw chuck. No need for 4 jaws. Available in 4" 5", 6" diameters.

6 STEP-JAW COLLET CHUCK

Centers work easier and quicker. Grips soft metals and tubes with less pressure. Holds bar stock firmer. It takes $1,000 worth of other equipment to equal the work capacity of this chuck.

6 JAW PRODUCTION COLLET CHUCK

For faster production on repeat external gripping operations.

Buck AJUST-TRU CHUCKS

BUCK TOOL COMPANY • 1010 Schippers Lane, Kalamazoo, Mich.

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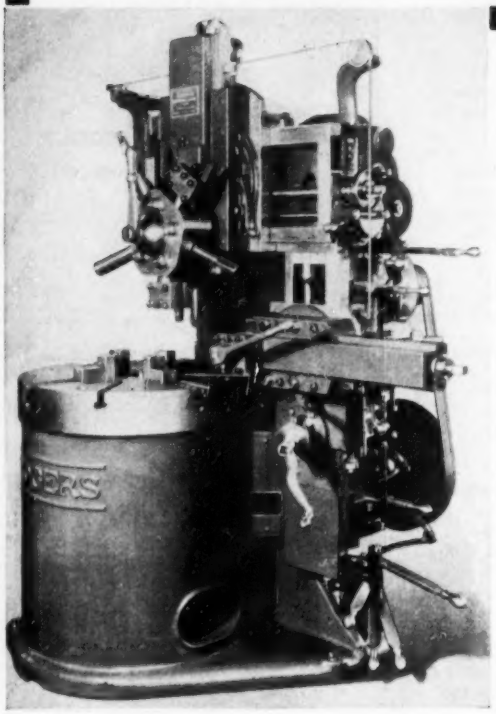
What Users Say About

ROGERS *"Perfect 36"*

VERTICAL TURRET MILLS



1. ". . . during the war they had seven of these machines and they did a perfect job on the work for which they were purchased."

2. ". . . two Rogers were crowded to and beyond their capacity, 24 hours a day. The operator said that he can face work on these machines and found there is no more than two-tenths of a thousandth variation in the two ends."

The above two excerpts are from a letter dated September 5, 1950 in which a prospect reports the enthusiastic recommendations by two users of Rogers Mills.

BORE
TURN
DRILL
THREAD

ferrous and non-ferrous castings and forgings on Rogers "Perfect 36" Vertical Turret Mills. Write for catalog TODAY.

Why Pay More for a Used Machine than for a NEW **ROGERS?**

Only $8560.00

ROGERS
MACHINE WORKS

1404 SENECA STREET • BUFFALO 10, N. Y.

Knowing How Since 1885

these heavy-duty features improve light-duty performance on . . .

13"
15"
17"
19"
21"
24"

Le Blond 21" Regal Lathe

LeBLOND REGAL LATHES

GEARED HEADSTOCK—Power is transmitted efficiently from motor to spindle at 8 conveniently-selected speeds. Gears, steel—spindle bearings, anti-friction.

QUICK-CHANGE FEED BOX—Up to 63 feeds and threads chosen simply, quickly through this fool-proof mechanism.

SEPARATE LEADSCREW AND FEED ROD—To give you long-life thread-chasing accuracy, smooth, powerful feeds.

TAPER KEY DRIVE SPINDLE NOSE—Safe, rugged and accurate positioning of chucks, faceplates and fixtures is assured by this heavy-duty feature.

ONE-PIECE APRON—Trouble-free sturdiness and protection from dirt and misalignment are built into the double-wall apron. The positive-jaw clutch means *positive* feeds.

Why can LeBlond build these heavy-duty features into Regal Lathes . . . giving you the most rugged, dependable performance in the light-lathe class?

Because only LeBlond can tap the vast engineering and production facilities of a plant building 76 lathe models. Add to this LeBlond's 63 years of leadership in machine tool design and production . . . and you have the LeBlond *combination* for top value in lathes.

Call your nearby LeBlond distributor for more information or write—

THE R. K. LEBLOND MACHINE TOOL CO.
Cincinnati 8, Ohio

Sales Offices: New York • Chicago • Detroit

NOTE: *LeBlond also builds Regals in these models:*
13" Bench
17", 19", 21", 24" Gap
17/28" and 19/30" Sliding Bed Gap.

LeBLOND Regals

World's largest builder of a complete line of lathes

COST WHEN MADE FROM FORGINGS—$1.714

Cost of forging per unit . . **$0.4228**

Production cost per unit (broached and then machined on chucking automatic) **$1.2912**

TOTAL COST PER UNIT—$1.714

COST WHEN MADE FROM TIMKEN TUBING—$1.47

Cost of tubing per unit . . **$0.293**

Production cost per unit (with mill-length tubing on 4-spindle 5" capacity automatic screw machine) **$1.177**

TOTAL COST PER UNIT—$1.47

Why this sleeve now costs 24.4¢ less

WHETHER you're making your hollow cylindrical parts from forgings or bar stock, chances are you can save money by switching to Timken® seamless tubing. For example, by using Timken tubing in place of forgings for the sleeve part shown here, the manufacturer cut his costs from $1.714 to $1.47 per piece.

This saving was possible for two reasons: 1. Unit for unit, Timken seamless tubing was far less expensive than forgings. 2. The mill lengths of tubing could be broached and machined on an automatic screw machine, whereas the forgings had to be broached and then maintained on a chucking automatic. The saving was so great that the cost of the new screw machine and tooling —$33,000—was more than paid for during the first year. The tables above give you the actual cost breakdowns.

Timken seamless tubing offers cost advantages over bar stock as well as forgings. The hole is already there. You can often start right in with finish boring. Scrap loss is reduced—machining time saved.

And you get better quality too. The piercing process by which Timken tubing is made is basically a forging operation, resulting in greater product strength. From tube to tube and heat to heat, this fine forged quality is always uniform, thanks to Timken's rigid controls.

OUR TUBE ENGINEERING SERVICE will choose the most economical size tube for you . . . guaranteed to clean up to your finish dimensions. Write The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

Specialists in alloy steel—including hot rolled and cold finished alloy steel bars—a complete range of stainless, graphitic and standard tool analyses—and alloy and stainless seamless steel tubing.